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THE PERKINS OBSERVATORY OF THE OHIO WESLEYAN UNIVERSITY.

By CLIFFORD C. CRUMP.

The Perkins Observatory is the gift of Professor Hiram Mills Perkins and his wife, Caroline Barkdul Perkins, to the Ohio Wesleyan University, Delaware, Ohio. Professor Perkins who was born near Marietta, Ohio, in 1833, graduated from Ohio Wesleyan in 1857. After his graduation he became an instructor in the University and for fifty years continued as a member of its faculty. With a salary which at no time exceeded $1800 a year, Professor and Mrs. Perkins saved and invested in such a way that they were able to give towards the erection of the observatory, which bears their name, over $200,000; the largest individual gift that the University had received. To this amount $91,000 was added as an endowment for the "Professorship in Astronomy and Directorship of the Observatory" by Professor Perkins' sister, Sarah Perkins Howard, and her husband, Clinton Howard.

For half a century Professor Perkins had as his goal the erection of an observatory for his alma mater. This steadfastness of purpose was due to his ambition to give to the students who came to the Ohio Wesleyan University the best equipment he could provide for their instruction in Astronomy. He believed that the public should have an opportunity to see with a great telescope the objects such an instrument reveals and by so doing "Learn to love God and serve Him more acceptably." In addition to these motives it was his ambition to provide the University with an observatory that would be able to carry on effectively a research program. He realized that Ohio Wesleyan using as her stock in trade the world's accumulation of knowledge should acknowledge her debt of gratitude by contributing to that fund of knowledge and in so doing benefit not only the students at Ohio Wesleyan but students everywhere.

Professor Perkins died on the 25th of January, 1924, while the Perkins Observatory was under construction. He had seen the plans for the telescope and the building and from a distance he had seen the massive concrete piers which were to support the Perkins Reflector.

In 1897, Professor Perkins gave Ohio Wesleyan the Students Observatory. Its building was designed by S. R. Baduley of Cleveland, Ohio. It is built of rough-faced grey brick and is located in Delaware, about a quarter of a mile from the main campus of the University. In 1923 the space in the building became inadequate to meet the growing interest in Astronomy and an addition to the observatory was built un-

der the direction of the writer which doubled the original floor-space. In addition to the tower for the telescope, there is a room 12x13 feet, for the transit; a laboratory, 40x24 feet, and an office 10x14 feet. There is, also, a dark-room for photographic purposes and available space for experiments in the basement of the building. The roof of the addition was made suitable for setting up small instruments and for general use as an observing platform. This feature proved to be very acceptable and it is to be highly recommended for observatories which are constructed primarily for the purpose of instruction. The Observatory is equipped with a Warner and Swasey refractor carrying a 9½-inch visual objective by Brashear; a photographic doublet of 6-inch aperture and 36-inch focal length, also by Brashear; a 4-inch transit by Warner and Swasey; a Howard Sidereal clock; a chronograph; a radio for receiving time signals; a spectroscope, and other instruments designed for class and laboratory use. The Students Observatory has facilities and equipment that any institution of the size of Ohio Wesleyan might justly be proud to own.

Adjoining the campus of the Students Observatory is the former residence of Professor Perkins. This was given to the University by Professor and Mrs. Perkins. It was their wish that the home which they built and occupied for more than fifty years should be the home of the Director of the Observatory at Ohio Wesleyan.

The original plan was to erect the Perkins Observatory near the Students Observatory. A careful investigation by the writer showed that the efficiency of a great reflecting telescope would be seriously handicapped by the lights and smoke of Delaware which has a population of approximately 10,000. Professor Perkins consented to a revision of his plan and a location was selected 3.4 miles south of the University. The site chosen is easy of access to the University, an interurban and a concrete road connecting the main campus and the Observatory. The University owns approximately 300 acres of land around the Observatory and has certain rights over some of the adjacent property. It is felt that the telescope is at least partially protected from influences which might be harmful to its best interest for the future.

After a careful study of the problems involved and after visiting and consulting those who are responsible for the construction and use of large reflecting telescopes the writer chose the type of mounting of the Ann Arbor and Victoria reflectors. Accordingly, contracts were awarded on June 8, 1922, for the mechanical parts of the instrument and for the dome to the Warner and Swasey Company, of Cleveland, Ohio, for the sum of $93,850. At the same time a contract was made with the J. B. McDowell Company of Pittsburgh for all the optical parts required, including a 61-inch mirror of crown-borosilicate, for the sum of $33,316. The work of designing the instrument began at once under the direction of Mr. E. P. Burrell, and the instrument was completed with the well-known thoroughness and precision of the Warner

and Swasey Company.

The mounting of the Perkins Reflector is of the cross-axis type. The polar axis rests upon two pier heads and is turned in right ascension by a worm wheel and worm. A sleeve attached to the polar axis and extending at right angles to it carries the declination housing. The declination axis passes through the polar axis and sleeve into the housing where the mechanism which produces the motion in declination is placed. The tube of the telescope consists of three parts, the center piece which is supported from the declination axis, the mirror cell at the lower end and the strong structural steel tube at the upper end. The telescope rests upon a concrete base, 12x18 feet, which supports two heavy columns of reinforced concrete upon which are placed the iron castings carrying the upper and lower ends of the polar axis.

The north pier head contains Timken radial self-aligning ball bearings. It is bolted firmly to the concrete pier and contains the necessary means for adjusting the polar axis in altitude and azimuth. The south pier head supporting the lower end of the axis contains the end thrust with roller and ball bearings. It, also, carries the mechanism for obtaining the right ascension quick motions.

The polar axis is made of three heavy steel castings securely bolted together. The central section is a hollow cube measuring three feet on each edge. It is through this that the declination axis passes. The upper and lower sections of this axis are slightly conical in shape, terminating at their smaller ends in forged steel extensions.

The declination housing is a large circular box casting attached by a sleeve to the rectangular center piece of the polar axis. Outside this housing is the declination circle graduated to one degree. With the aid of an index mark the setting of the circle can be estimated to a quarter of a degree. This has proved to be of sufficient accuracy for setting the instrument. The declination housing besides containing the mechanism for turning the telescope in declination serves as a counterweight for balancing the tube about the polar axis. The declination axis, itself, is a long steel shaft with a large flange at one end. It rests upon radial self-aligning bearings, held by a retaining cell in the rectangular section of the polar axis and upon radial and thrust self-aligning ball bearings at the housing of the declination sleeve. In this case, as in all others, where ball bearings are used, they are properly encased, permitting them to be well packed in grease.

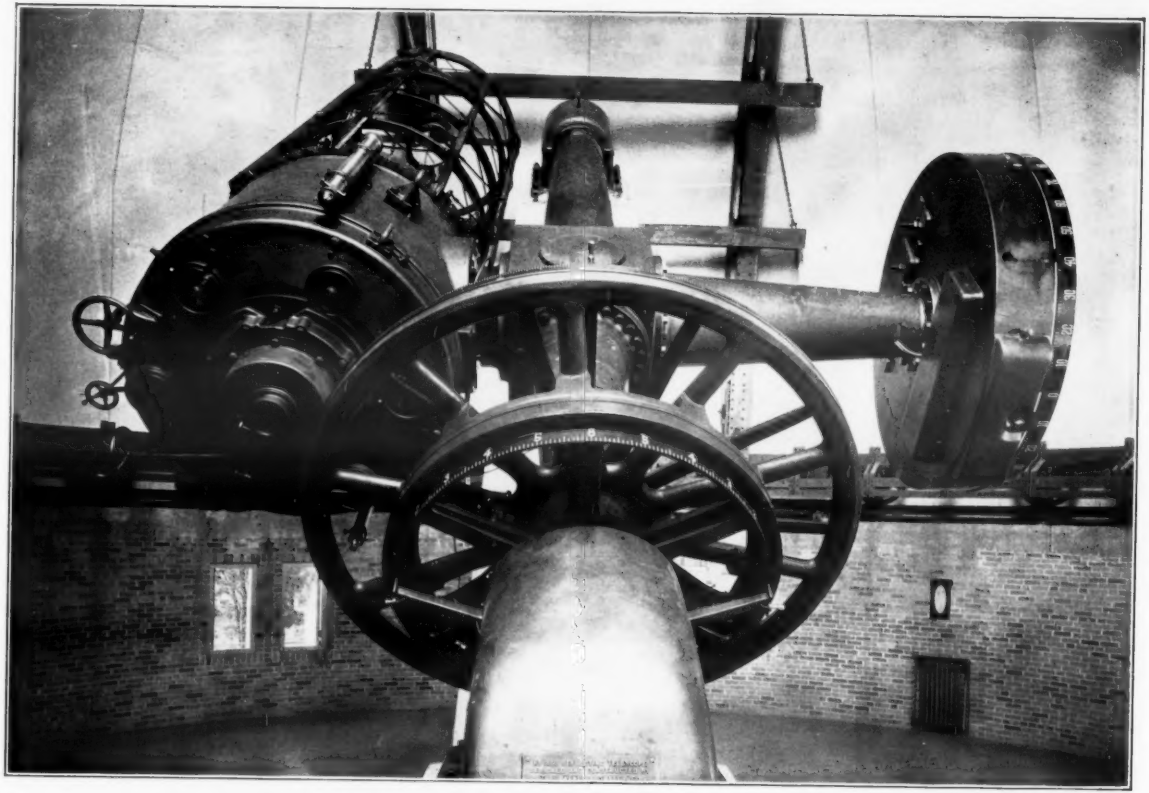
The center piece of the telescope tube is a large cylindrical ribbed casting weighing 6700 pounds. On one side there is a large socket for attaching it to the declination axis. At the upper and lower ends are flanges for attaching the structural steel tube and the mirror cell. The mirror cell is a pan-shaped casting with a flanged upper edge for attaching it to the lower flange of the center piece. Over the top of the center piece a shutter consisting of eight leaves is placed for the protection of the mirror. This shutter may be opened and closed by a hand wheel at the bottom of the tube. Two 4-inch finders are attached to

this part of the tube. They are conveniently located for setting the instrument. The mirror is supported in its cell in a manner similar to that employed in the design of the 72-inch reflector at Victoria. Under the mirror cell is attached a casting for holding the spectrograph. It is constructed in such a way that it may be rotated in any position angle. Provision is also made for inserting a tube carrying a diagonal eye-piece for observing visually at the Cassegrain focus without removing the spectrograph.

The telescope tube is an octagonal skeleton constructed of longitudinal T-bars with their stems turned outward. These are firmly united and stiffened with tie-rods and turn buckles providing great rigidity in every position of the tube. The tests that have been made, indicate that the maximum deflection of any position of the tube is well within the limits of the optical requirements. At the upper end of the tube are four radial webbs, or supporting vanes of ⅛-inch sheet steel, holding a casting of ½-inch aluminium alloy of ⅜-inch thickness. These have their outer ends bolted to the steel work of the tube and they carry the circular casting 17 inches in diameter which supports the secondary mirrors which may be either a flat 17½ inches in diameter for observing at the Newtonian focus, or a convex mirror, 16 inches in diameter for observing at the Cassegrain focus. On the upper side of this casting there may be placed a conical extension of aluminium for supporting the plate-holder, an eye-piece, a spectrograph, or other apparatus to be placed at the primary focus. This arrangement has permitted the tube to be made shorter than has been the custom heretofore. The change from using the instrument at the Newtonian focus to the Prime focus can be easily accomplished by one man in a few minutes time.

The driving clock is of the Warner and Swasey type. It is mounted on a concrete base just in front of the concrete column supporting the south pier head. The mounting of the clock is so arranged that the clock as a unit can be moved out from the telescope should such a need arise. The main driving worm is mounted directly on top of the clock housing. It is driven at the rate of one revolution every two minutes. This worm meshes with the accurately cut bronze worm-wheel, mounted on ball-bearings at the lower end of the polar axis and attached to it by an electrically operated clutch. The slow motion in right ascension is effected by two sets of differential gearing actuated by means of solenoids which receive accelerated motions through an auxiliary electric motor. This arrangement gives two speeds, one slower, the other faster, than the sidereal drive. This mechanism is constructed as an integral part of the clock and is operated by push buttons mounted in hand blocks which are accessible at either end of the telescope. A train of gearing and an electric motor are mounted in the south pier head for the quick motion in right ascension. The sidereal circle is attached to the driving worm-wheel. It is used for setting the right ascensions directly, eliminating the computation of hour angle. The circle is graduated to two minutes and the setting can be accurately estimated to one-

PLATE XVII



THE SIXTY-ONE-INCH PERKINS REFLECTOR.

PLATE XVIII

THE SIXTY-ONE-INCH PERKINS REFLECTOR.

half a minute. The hour circle is graduated to five minutes of time.

The mechanism for the slow and quick motions in declination is encased in the declination housing. A small reversing motor with gearing operates the driving worm. Shifting attachments operated by solenoids give two speeds in either direction, also a quick motion in either direction for setting the instrument in this coördinate. The slow motions are controlled by push buttons mounted in the same blocks as the push buttons for the right ascension slow motion. The quick motion for both coördinates is operated from the west side of the south pier head.

At the lower end of the central section of the tube are three heavy eyes corresponding in position to similar ones attached to the mirror cell. By means of pulleys fixed in these eyes the mirror cell can be lowered by hand on to a strong table for silvering the disc. The table is so constructed that when the cell is placed on it, it can be rocked freely. Provision has been made for catching the solutions poured off the disc by placing a large pan under the table supporting the cell. The simplicity of this arrangement and its efficiency recommend it.

The specifications for the optical parts of the reflector called for a principal mirror 61 inches in diameter with a central hole of eight or nine inches aperture. The ratio of thickness to the diameter was to be one to six, and the ratio of aperture to focal length, one to five. The 16-inch Cassegrain secondary mirror was specified to have a radius of curvature of about seventeen feet and to be located about 6.08 feet from the principal focus of the 61-inch mirror so as to give a combined ratio of one to eighteen. The Newtonian flat was specified to be elliptical in shape with axis 12½ by 18½ inches respectively.

In December, 1923, occurred the death of Mr. McDowell, the head of the company bearing his name. Mr. McDowell had been unable to procure a disc of sufficient size and quality for the reflector, and at the time of his death only the minor optical parts were completed, including the Newtonian flat. After unsuccessful attempts to secure the disc in this country the writer made an appeal to the Bureau of Standards at Washington. With the interest of the Director, Dr. George K. Burgess, and with the sanction of Secretary Hoover of the Department of Commerce, experiments were begun, to learn the method of producing large discs of optical glass in this country which were suitable in size and quality for making great reflecting telescopes. These experiments were placed under the direct charge of Mr. A. N. Finn. After four unsuccessful attempts, a disc 70 inches in diameter, 11 inches thick and weighing approximately 4000 pounds was taken from the annealing oven on the 21st of January, 1928. A test by polarized light showed that the disc had been well annealed, the strain figure being well centered. The delicate operation of cutting a hole through the disc was undertaken with success at the Bureau of Standards and the disc was placed in the hands of the J. W. Fecker Company for figuring, during

the first days of September, 1928.*

During the period required for the construction of the disc the building for the Observatory was completed and the mounting erected. The cost of erecting the mounting, including the freight and insurance from Cleveland, Ohio, was approximately $9,000. One of the 60-inch mirrors made by the late Dr. A. A. Common of England and now owned by the Harvard College Observatory was loaned to the Perkins Observatory. With this mirror the reflector was first used in January, 1925.

In the design of the building the threefold purpose which Professor Perkins had for the Observatory was carefully considered. It was also borne in mind that the building, as well as the telescope, was to be a monument to the donors. The firm of Talmadge and Watson of Chicago was selected as the architects and at a ground breaking ceremony on May 23, 1923, the actual work of construction began. The building was completed by the fall of 1924. It is of one story with the tower for the telescope two stories in height. Its outline is simple, being a rectangle 98 by 52⅓ feet with an adjoining tower for the telescope 55⅔ feet in diameter. The material used for the construction was seven different shades of rough-faced grey brick, Bedford stone, marble, tile, and copper. Considerable attention was paid to the details of the construction and to the ornamental features of the building. The main entrance is a Belvedere which contains a handsome reproduction of Robert de Lorain's "Apollo Watering the Horses of the Sun." The pedestals on either side of the entrance are capped by reproductions in stone of two of the angels depicted in Burne-Jones' picture, "The Days of Creation." The pilasters between the windows terminate with capitals upon which are carved American Indian astronomical symbols. Around the building is a frieze of verde antique marble panels bearing the names of seventeen astronomers: Pythagoras, Aristarchus, Erathosthenes, Hipparchus, Ptolemy, Copernicus, Tycho Brahe, Galileo, Kepler, Newton, Laplace, Herschel, Fraunhofer, Huggins, Newcomb, Kapteyn, Barnard. These panels are separated by stone carvings representing the signs of the zodiac. The building contains a lecture, or class room which accommodates 100 people, a library, offices, rooms for photographic purposes and laboratories. The cost of the building was approximately $152,000.

The 55-foot dome is a structural steel frame covered inside and out with Armco sheet metal. The sheathing is arranged to provide free circulation of air between the two coverings. The air enters through openings at the base of the dome and passes out from spaces provided at the top. The shutters are built in a similar fashion. The free circulation of air aids in keeping the temperature of the dome uniform. The frame of the dome consists of two main circular arch ribs extending

*A report on the methods used in making the disc has been published in the August, 1929, issue of the *Bureau of Standards Journal of Research.*

entirely across and spanning the base ring, one on either side of the shutter opening. These ribs form a support for the auxiliary rib systems, the shutter tracks, the observing bridge and the wind curtains. A stair is attached to the base of the dome and extends to the floor from a platform which is on a level with the observing bridge when this is in its lowest position. The weight of the dome is about 78 tons, 9 tons of sheet metal, 19 tons of machined parts, each shutter about 4 tons, and 3 tons for the bridge. The dome is carried by a system of trucks having shafts with Timken roller bearings and ball end thrusts. The turning mechanism is operated by a direct current motor of 22.5 h.p. which turns the dome through an endless cable. A counter-weight system is provided to keep the turning cable at the proper tension. The dome may be moved by a switch from either the observing bridge or from the west side of the south pier on the floor of the tower room. The dome is carried by twenty-six steel wheels.

The shutters which cover an 11-foot opening are carried on roller bearing trucks and are guided laterally by trucks with similar bearings. They are operated by a 5 h.p. motor which is mounted on the structural work of the dome at the lower end of the shutter opening. The shutters are actuated from the observing platform or from the end of the stair which is attached to the base of the dome.

The observing bridge extends across the shutter opening. It is made of structural steel and is so designed that it will hang in a level position wherever it may be. The bridge can easily carry a load of 600 pounds. An extension wing at either end of the bridge, movable by hand, permits the observer to reach the telescope when it is in any position for either visual or photographic observations.

Some of the outstanding features of the Perkins Reflector are of interest. Only four electric motors are employed to give all the motions required and to wind the clock. Heretofore it has been the custom to use many more than this in telescopes of similar size. The design also permits the use of a much shorter over-all length without reducing the focal length of the combinations employed. All the motions in right ascensions are in the driving clock unit and all the mechanism for operating the telescope has been eliminated from the north and south pier heads.

With the completion of the mirror which is now being figured in Pittsburgh the Perkins Reflector will take its place as one of the great instruments for astronomical and astrophysical research. It is the first reflecting telescope of large aperture to be entirely constructed in this country. It is a superior instrument and it is the hope of the writer that it will prove to be worthy of the sacrifice and the devotion of its donor, Professor Hiram Mills Perkins.

August, 1929.

REPORT ON MARS, NO. 43.

By WILLIAM H. PICKERING.

Drawings of the Apparition of 1926, Continued.

This opposition occurred on November 4, but the planet was nearest to the Earth on October 27, when its diameter was 20″.4, or about four-fifths of what it had been at the previous opposition. This was still unusually near, however, and favorable for investigation. The solar longitude ⊙ was 326°.0, corresponding to M.D. January 49, but as the southern hemisphere was turned strongly towards us, latitude —19°.7 being central, we had to do chiefly with summer conditions on the planet. The vernal equinox which occurs at ⊙ = 0°, M.D. March 1, did not arrive until February 1, 1927, when the planet's diameter was reduced to 8″.6. The southern hemisphere was therefore having its very hottest weather, and the northern its coldest, although we could not see the latter to much advantage. After September 10, when the solar longitude was 280°.3, and the planet's diameter 15″.7, it was nearer us than it had been in 1924 at the same season of its year. The average date of the drawings was October 30, or five days before opposition. In 1924 it was eleven days afterward. The difference is possibly in part due to the suggestion of the writer that early observations of the planet were likely to show more interesting changes than those made later in the planet's year. If the difference in the date is due to this cause, we trust that the various observers were not disappointed.

Our last Report was published in order to give early information of certain changes and shifts of the markings observed in 1928, for the benefit of other observers. It therefore appeared out of its chronological sequence. The present Report is really a continuation of No. **41**, and, as we have done on a previous similar occasion, the drawings of the various observers will be numbered in continuation of those given in the earlier Report, beginning with number 25, and will be discussed in connection with them. A third new observer, Mr. B. M. Peek, in addition to Messrs. M. A. Ellison and F. J. Hargreaves whose work has already been published, has sent in some very good drawings, showing many canals and a great many lakes. Owing to the otherwise regrettable delay in the appearance of this publication, we have been fortunate in securing five excellent drawings made by the well-known French observer, M. E. M. Antoniadi, taken from the December number of *L'Astronomie*. His work is available because he has now apparently adopted our plan of making drawings differing in longitude by 60°, and beginning with the longitude 0° for the central meridian. There is only one drawing which differs seriously, by 28°, from its required position. But one longitude, that for 240°, is omitted, presumably because he

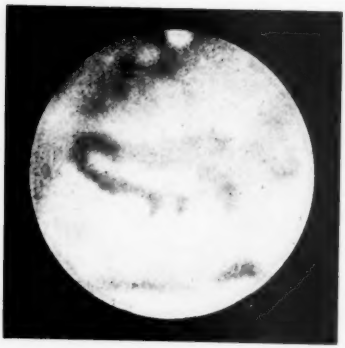


Fig. 25
Antoniadi 0° A

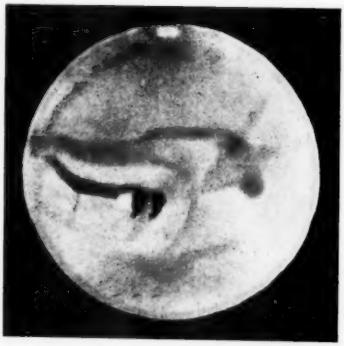


Fig. 26
Peek 5° A

Fig. 29
Antoniadi 75° B

Fig. 30
Peek 82° B

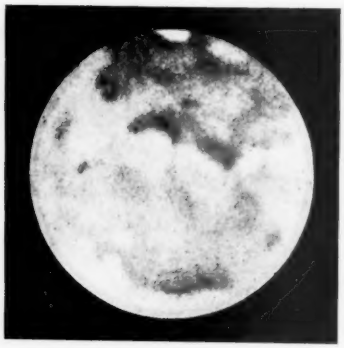


Fig 33
Antoniadi 148° C

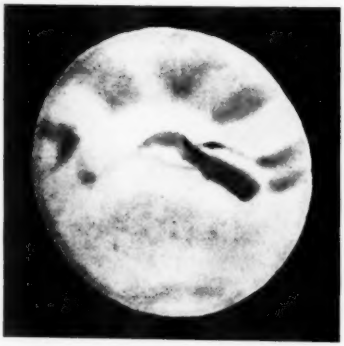


Fig. 34
Peek 136° C

DRAWINGS OF MARS IN 1926.

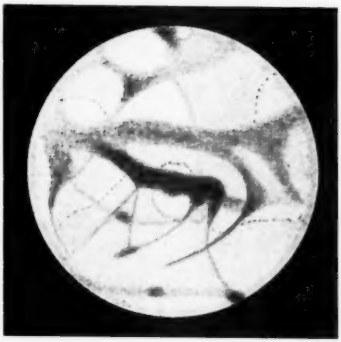


Fig. 27
Attkins 343° **A**

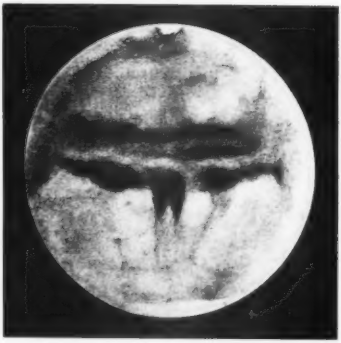


Fig. 28
Wilson 0° **A**

Fig. 31
Attkins 74° **B**

Fig. 32
Wilson 60° **B**

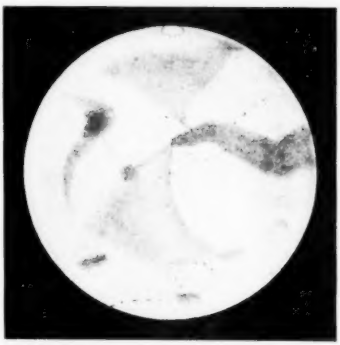


Fig. 35
Attkins 136° **C**

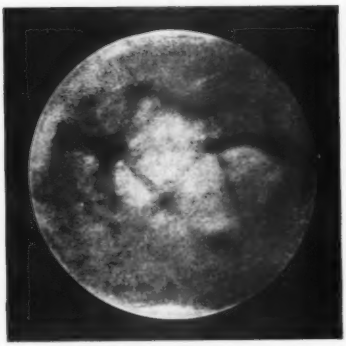


Fig. 36
Wilson 118° **C**

DRAWINGS OF MARS IN 1926.

could obtain no satisfactory drawing of it. He gives an interesting drawing in its place, but one not suitable for our work.

His drawings are instructive because made with the largest refractor in the eastern hemisphere, and are perhaps the best secured at this apparition in continental Europe, certainly the best I have seen. They would be very important indeed, if his seeing were good enough to take advantage of the large size of his aperture. Such, however, is not the case, but his skill as an artist and observer is such that the drawings give an excellent idea of how the planet looks when the seeing is fair, but not really first class. Indeed they closely resemble some by the late M. Trouvelot made at Harvard many years ago with the 15-inch refractor, and published in the *Harvard Annals* at that time. The seeing at Harvard was less favorable, however. M. Antoniadi gives the quality of his seeing only relatively and by description, but not on the Standard Scale. On one date, however, it must have been fairly good, because on that drawing are shown as many as 20 canals that are confirmed by other observers. Throughout the world the seeing improves as we approach the tropics, and get farther and farther away from the anticyclones of the temperate zones. Thus in our southern states the seeing is much better than it is in the north, and better still as we go west, and get still farther away from the anticyclone tracks. We should expect the same to be true in Europe, and undoubtedly the seeing is better in Italy than in more northern countries. A curious exception to this rule, however, occurs in the case of the British Isles, and it is surprising that there, when they do get clear skies, the seeing appears to be appreciably better than it is in central France. Undoubtedly the moisture of their climate is largely responsible for this, giving small hourly changes of temperature. This is statistically the case in Jamaica, where our very best seeing occurs, as noted elsewhere, on our very wettest nights. Our Ceylon correspondent, Dr. F. O'B. Ellison, informed me in 1924 that it was probable that his drawings in 1926 would be very materially interfered with by the coming monsoon. This unfortunately has proved to be only too true, two of his six drawings, however, are good, and one of them, which is of about the same quality as those taken from *L'Astronomie*, has been inserted to fill the vacant space in M. Antoniadi's series.

During this apparition it may be noted that low magnifications were used as a rule, although Dr. Trumpler on three occasions used 520, and one other observer used 500. The lowest power used was 175 with a 6.5-inch aperture. The magnification that should be employed depends of course on the character of the detail, but also somewhat on the size of the planet. When the latter was very remote I have used even as high as 600 with an 11-inch aperture, but 55 diameters to the inch requires very good seeing indeed, as well as a good instrument.

DESCRIPTION OF THE DRAWINGS.

The designations, names, addresses, and equipment of the observers are as follows:

Ad. M. E. M. Antoniadi, L'Observatoire Astronomique, Meudon, France. 32.7-inch refractor by the MM. Henry.

Pe. B. M. Peek, F.R.A.S., Gorse Cliff School, Herne, Kent, England, since removed to Sohan, Silhill Hall Rd., Solihull, Birmingham. 12.2-inch reflector by Linscott. Magnifications 225, 300. Seeing 2 to 8.

Ak. E. A. L. Attkins, F.R.A.S., 2 Outred Villas, Squirrel's Heath, Romford, Essex, England. 8.5-inch reflector by Dall. Magnifications 480 and 330. Seeing on the Standard Scale 5 to 10.

W. L. J. Wilson, Esq., Box 62, Franklin, Kentucky, U. S. A. The drawings were made at Nashville, Tennessee. 11-inch reflector, without clock, made by himself. Magnification 350. Seeing on the Standard Scale 7 and 8.

D. Professor A. E. Douglass, University of Arizona, Tucson, Arizona, U. S. A. 36-inch reflector by Brashear, but used with an aperture of 13 inches. Magnification 225. Seeing on the Standard Scale 5 to 9.

E. Dr. F. O'B. Ellison, Colombo, Ceylon. 12-inch reflector. Mirror by the Rev. W. F. A. Ellison, mounting by himself. Magnifications 275 and 500. Seeing on Standard Scale 6 to 8.

N. K. Nakamura, Esq., Astronomical Observatory, Imperial University, Kyoto, Japan. 12.8-inch reflector by Calver. Magnifications 222 and 405. Seeing on the Standard Scale 7 to 13.

As in our Reports pertaining to the six previous apparitions, the drawings are arranged in the order of the longitudes of the stations from which they were obtained, beginning with the European ones. All the drawings in the same horizontal row represent approximately the same Martian longitude. In the vertical columns the longitudes are intended to differ by 60°, beginning with longitude 0°. Thus six views of the planet are shown by each observer, covering the whole visible surface. These six regions are indicated by the letters **A, B, C, D, E,** and **F.** In Table I is given a statement of the main facts relating to the various drawings. This Table is arranged as in previous Reports, the successive columns giving the number of the figure, the designation of the observer, the aperture of his instrument, the magnifications employed, the seeing on the Standard Scale, which is described in Report No. **9**, the date of the drawing in Greenwich Civil Time, the region depicted, the longitude of the central meridian, its deviation from the desired standard, the latitude of the center of the disk, the angular diameter of the planet, the longitude of the Sun as seen from Mars, as described in the *Ephemeris,* and the corresponding Martian Date taken from Report No. **10**.

TABLE I.

FUNDAMENTAL DATA OF THE FIGURES.

Fig.	Obs.	Aper.	Magn.	Seeing	1926	Reg.	Long. °	ΔLong. °	Lat. °	Diam. ″	☉ °	M.D
25	Ad	32.7			Nov. 15.7	A	0.7	0	—18	19.1	319.2	Jan. 37
26	Pe	12.2	300	5	Nov. 25.0	A	5	+ 5	—20	17.6	324.9	Jan. 47
27	Ak	8.5	480	10	Nov. 22.9	A	343	—17	—19	17.9	323.7	Jan. 45
28	W	11.	350	8	Oct. 21.9	A	0	0	—14	20.3	305.6	Jan. 14
29	Ad	32.7			Dec. 15.7	B	75	+15	—20	14.3	335.6	Feb. 10
30	Pe	12.2	300	8	Oct. 7.0	B	82	+22	—13	19.1	296.7	Dec. 54
31	Ak	8.5	480	5	Nov. 14.9	B	74	+14	—18	19.1	319.2	Jan. 37
32	W	11.	350	8	Oct. 20.2	B	60	0	—20	20.2	304.4	Jan. 12
33	Ad	32.7			Nov. 1.8	C	148	+28	—16	20.3	311.2	Jan. 23
34	Pe	12.2	300	5, 6	Oct. 3.0	C	136	+16	—12	18.6	294.3	Dec. 50
35	Ak	8.5	480	8	Nov. 10.0	C	136	+16	—18	19.7	316.5	Jan. 32
36	W	11.	350	8	Nov. 17.1	C	118	— 2	—19	18.8	320.4	Jan. 39
37	Ad	32.7			Dec. 6.7	D	178	— 2	—20	15.7	330.8	Feb. 1
38	Pe	12.2	300	6, 7	Nov. 2.0	D	199	+19	—16	20.3	311.9	Jan. 24
39	Ak	8.5	330	7	Nov. 1.9	D	190	+10	—16	20.3	311.9	Jan. 24
40	W	11.	350	8	Nov. 12.2	D	181	+ 1	—18	19.6	317.5	Jan. 34
41	E_2	12	275, 500	6, 8	Nov. 26.7	E	237	— 3	—20	17.3	325.4	Jan. 48
42	Pe	12.2	225	2, 4	Oct. 26.9	E	237	— 3	—15	20.4	308.4	Jan. 19
43	Ak	8.5	480	8	Dec. 4.9	E	255	+15	—20	16.0	330.3	Feb. 1
44	W	11.	350	7	Nov. 6.2	E	244	+ 4	—17	20.0	314.2	Jan. 28
45	Ad	32.7			Oct. 19.9	F	292	— 8	—14	19.8	303.7	Jan. 11
46	Pe	12.2	300	4, 6	Oct. 21.9	F	284	—16	—14	20.3	305.5	Jan. 14
47	Ak	8.5	330	6, 7	Oct. 20.9	F	276	—24	—14	20.3	304.9	Jan. 13
48	W	11.	350	8	Nov. 1.2	F	300	0	—16	20.3	311.4	Jan. 24
49	D	13.	225	7, 8	Oct. 26.2	A	347	—13	—15	20.4	307.9	Jan. 18
50	N	12.8	222	8, 9	Nov. 8.6	A	3	+ 3	—17	19.9	315.3	Jan. 30
51	D	13.	225	8, 9	Oct. 18.2	B	61	+ 1	—14	20.1	303.2	Jan. 10
52	N	12.8	222, 405	11, 13	Nov. 2.8	B	57	— 3	—16	20.3	311.9	Jan. 24
53	D	13.	225	8, 9	Oct. 12.2	C	114	— 6	—13	19.6	299.7	Jan. 4
54	N	12.8	222, 315	9, 12	Oct. 25.7	C	124	+ 4	—15	20.4	307.3	Jan. 17
55	D	13.	225	5, 6	Oct. 12.4	D	167	—13	—13	19.6	299.8	Jan. 4
56	N	12.8	222	8, 10	Oct. 19.6	D	178	— 2	—14	20.2	303.8	Jan. 11
57	D	13.	225	7	Nov. 2.1	E	236	— 4	—16	20.3	312.0	Jan. 25
58	N	12.8	222, 315	8, 9	Oct. 10.5	E	238	— 2	—13	19.4	298.5	Jan. 2
59	D	13.	225	8, 9	Nov. 1.2	F	287	—13	—16	20.3	311.4	Jan. 24
60	N	12.8	222	7, 9	Nov. 9.4	F	302	+ 2	—17	19.8	315.9	Jan. 31

OUR PRESENT MAPS OF MARS.

The largest part of the work in the preparation of this Report by far lay in the identification of the various canals and lakes. On the sixty different drawings it was found that there were 847 identifications of 189 canals, and 318 identifications of 110 lakes. The difficulty of this work was enormously increased by the lack of any suitable map of the region observed. Such a map must show not only the canals and lakes themselves, but must also furnish short legible names by means of which they may be described. With so many canals as appeared in 1926 it was obviously impossible to continue the use of Flammarion's and Antoniadi's map, published in Flammarion's *Mars II* and in Report No. **15**. This map contains 120 canals in all, and of these only 58 were drawn by the twelve observers in 1926,—all the others were different. We must, therefore, go back to Lowell's maps for our identifications, but

there are several objections to their form of publication, or to their use for general purposes. In the first place there are half a dozen of them scattered through his three massive volumes of *Annals,* and there is no one map of the southern hemisphere showing even all the chief canals. Again they are reproduced by the half-tone process, and are too faint. A photographic copy of any one of them would be quite illegible. Finally many of his canals were not seen at all this year, and many more were seen which he never recorded. As a result, if, as is thought may be the case, many of the fainter canals are merely shower tracks, then these properly speaking will never be seen again, although other showers may occur in nearly the same places. Fortunately a Danish lady, some years ago, Miss Brun by name, very kindly presented me with a large globe which she herself had painted, showing very distinctly all of Lowell's canals. This globe was based on unpublished photographs of drawings upon a globe made by Lowell himself, and has been of the greatest assistance in the work of identification, and has enabled me to avoid searching through all his maps, and photographs, and perhaps of not finding the proper canal after all. Of other maps that of Jarry-Desloges is clear, but shows only his own canals, and the names in many cases are different from those to which we are accustomed. Trumpler's recent map shows also only those canals seen by himself, and gives very few names. Obviously a new map brought up to date, showing all the canals that have appeared recently on Mars, and omitting all those that have not been seen for years, and may perhaps never be seen again, is badly needed. It is hoped to supply such a map in one of our forthcoming Reports, but until it appears those of my readers who have not access to all the maps above specified will have to accept the names here given without any indication, other than the letters from **A** to **F**, of the location of many of the corresponding canals.

Identification of the Canals and Lakes.

It should be recognized that an identification is not merely a matter of recording what marking on a given map most nearly resembles a marking in a drawing. Suppose that we have two drawings and both differ from the map, and still more from one another. How much difference shall we allow before we conclude that the drawings represent different objects? Take for example the canal Peneus in the following side of Hellas, which both Schiaparelli and Lowell represent on their maps as straight, and running nearly east and west. Phillips draws a canal in about the same place, Report No. **41**, Figure 21, strongly concave to the north, while if it were really straight it should appear concave to the south. Trumpler draws a straight canal, Figure 24, pointing towards the edge of the polar cap and in the photograph of his original drawing perhaps connecting with it. Are they the same canal, and is it a case of confirmation, or are they two separate unconfirmed canals counting against both observers? Nakamura, Figure 60, on this point partly confirms Phillips. Again in the same drawings Trumpler draws the

marking Rha, southeast of Hellas and near the limb, as a well-defined canal. Phillips draws what is evidently the same marking as a broadened area which we should never think of calling a canal. If we credit Trumpler, as seems natural, it seems as if we should credit Phillips also. But how about Douglass' still broader area extending farther both east and west than Hellas, but excepting for its width resembling Trumpler's? He has of course always seen the canals wider than other observers, but should he be ruled out in this concrete case? He appears to me to have drawn the canals in general narrower this year than heretofore.

Trumpler like Schiaparelli and Lowell draws them very narrow, but he at least generally makes some difference in their breadth, which the other two, with a few exceptions, did not. In 1924 with the Harvard 11-inch I drew them of about the same width as he did in regions **A**, **B**, and **F**, but wider in **D** and **E**. My seeing when the latter drawing was made was poor, which probably accounts for the difference in that case. Trumpler furnished no drawing of region **C**. In 1926 with my 12-inch reflector, only in the case of **E** did I draw them nearly as narrow as he. In that case my seeing was good, and his rather unusually poor. The difference in the two years was obviously due in my case to the inferior defining power of a reflector as compared with a refractor. Nevertheless by the use of the electric fan, driving the warm air out of my tube, I am hoping to get some narrow canals at future apparitions. My impression is that, if Trumpler and I were to look at Mars under favorable weather conditions with either the 11-inch refractor or the 36-inch, the canals would appear to us with either instrument of about the same width, as was the case when we were using different instruments in 1924. Since, moreover, we both drew the canals of all degrees of width, I believe that the widths shown were really nearly correct. Some were as fine as they could be drawn, but whether these were really too wide or too narrow we have at present no certain means of judging. With poor seeing a dark line drawn on paper appears rather narrower than it really is. Moreover since the canals are not black on white, but presumably gray on yellow, this would also tend to make them appear narrower than they really are. On a 2-inch drawing of Mars the width of a pencil line ranges from 20 to 30 miles. Measures of some of the better drawings made in 1924, when the planet was near us, indicate that, since some of the canals were narrower than it was possible to draw them even on a 3-inch disk, the widths of the narrowest were less than 10, and possibly in some cases as narrow as 5 miles.

Since as we know even prominent canals sometimes shift their location on the planet, and since, moreover, Martian clouds or heavy precipitation will sometimes entirely conceal a region from one observer, and a few days later reveal it to another, unless allowance is made for these facts, identification may occasionally become very difficult. To illustrate this latter point, all of the canals in Aurorae shown in my drawing, Figure 7, and drawn on November 27, diameter of the planet

17″.3 (see Report No. **41**) were masked and blotted out by a dense precipitation, doubtless of water, darkening the whole region. No one else drew this area as late as that, but Attkins' drawing, Figure 31, and Ellison's Figure 6, dated November 15 and 16 respectively, show nothing of the kind. December 28 dense clouds covered the region, and it was nearly as bright as the deserts, but by January 2, 1927,these had cleared away, and the precipitation had again appeared in all directions, completely covering even Thaumasia, no canals, and not even Solis being visible, although the central meridian was 60°, central latitude —19°.7, and diameter of the planet 11″.7. A similar darkening of Libya has been recorded by many observers.

In the actual process of identification, when difficulties arise, it is often best to begin with the lakes shown, and after we have settled on their names, the names of the neighboring canals will become obvious. Thus in the case of Figures 5 and 7 the canals at first would not identify at all. The two most northerly lakes in the former are Lunae and Ascraeus, and we might naturally suppose that the same was true in the latter. The large northern lake in Figure 7 is Ascraeus, which has grown appreciably in size in the seven weeks since the earlier drawing was made. The other lake, however, is not Lunae, but Nilacus, connecting with Margaritifer by means of Indus. Lunae is shown above and between the two. It is drawn nearly in line between Ascraeus and Aurorae. In Figure 5 it is drawn well to one side. Both drawings are somewhat out of proportion in this respect, something about half-way between the two being correct. Having settled that, we find that the little lake north of Solis in Figure 7 is Pynx, which, however, seems to have increased its longitude by about 3°, or 130 miles if Lowell's location was correct, or else on the other hand is a new and more recent formation. The canal Catarractus joining it to Solis was not there in 1924, although observed many years previously by Lowell, who named it. Pynx had not developed at all when Phillips' drawing was made, but he shows three others Maesia, 118, and Phoenix not shown in Figure 7. Several of the canals in the latter drawing do not appear in that of Phillips. The surface of the planet in fact had changed materially between the two dates, and in that sense the drawings are not comparable, but the canals which fail to identify with one another in the drawings all show clearly when properly identified on the little 8-inch globe. This illustration is given as an example of a rather unusually troublesome identification, yet one which when correctly solved came out in a very satisfactory manner. In most cases, however, where all the drawings are made at about the same time, or when the planet is changing slowly, as at the time of the solstices, identifications are comparatively direct and easy.

The identification of all of the canals in each of the sixty drawings is given in Table II. The third and following columns are headed by the designations of the various observers, and each contains the letter or letters indicating the regions in which the canals are found. These let-

ters are given in Table I, and also under the drawings themselves. In the last column is given the number of observers who saw each canal, thus indicating its relative visibility. Where the work of two observers supplements one another, as in the case of Ellison$_3$ and Hargreaves, if both saw the same canal, it counts as only one. Lowell recorded many canals by number which were never named. These numbers are given after the named canals, but numbers 13, 14, and 15 refer to Report No. **35**, Figure 50. Finally certain canals not found on any previous map are indicated by capital letters.

TABLE II.

CANALS IDENTIFIED IN THE DRAWINGS.

No.	Canal	Ph.	E$_2$.	H.	Pk.	T.	Ad.	E$_2$.	Pe.	Ak.	W.	D.	N.Ob.
1	Abas			D		CD			CD				3
2	Achates	EF	F		EF	E	EF	E		E	E	EF	F	9
3	Acheron						D							1
4	Adamus	E			E								E	3
5	Aegyptus									A				1
6	Aesculapius			D		D					D	D		4
7	Aethiops		E			E			E		E	E	E	6
8	Agathodaemon	BC	BC		BC	B	B			B	C	BC	BC	9
9	Alpheus					F								1
10	Ambrosia	BC				B					BC	C		4
11	Amenthes	E				F				EF		EF	F	5
12	Anubis		F			F	F							3
13	Arabice									A	A			2
14	Araxes	BC	BC		C	C	BC		BC	C	BC	CD	C	10
15	Arges		C		D					D	D			4
16	Arius						F							1
17	Asopus					F	F							2
18	Astaborus											AF		1
19	Astapus					F	F		F	F		F		5
20	Australe	B			B	B						B		4
21	Avernus		E										D	2
22	Axon									C	D	D		3
23	Baetis					B				B	B	B	B	5
24	Balyra	BC				CD	B		D	C	C			6
25	Bathys										BC			1
26	Bradanus	AB	B	A	AB	AB			AB			AB	B	7
27	Brontes			D							D		C	3
28	Caicus				C	B	B					B		4
29	Calydon				BC					C	C			3
30	Cantabras	A									A		A	3
31	Casuentus								E					1
32	Catarractus	BC	B		BC	BC	B		BC	BC	BC	BC	BC	10
33	Cenion					CD			D				C	3
34	Centritis				F							EF		2
35	Cerberus			D		D				D	D	D	DE	6
36	Cestrus	B	B		A	AB					B	B	B	7
37	Chronium	D	C	D	D	CD	CD			D	C	CD	CD	9
38	Chrysorrhoas				C	B	B				B	B		5
39	Cimbus								D			D	D	3
40	Clitumnus					B	B			B				3
41	Clymene	EF	E			F	F				E	F		6
42	Cocytus						F							1
43	Coptos					C								1
44	Cyclops		E		E	E					E	E	E	6
45	Cyrus				C	B								2

TABLE II.—Continued.

Canals Identified in the Drawings.

No.	Canal	Ph.	E_3.	H.	Pk.	T.	Ad.	E_2.	Pe.	Ak.	W.	D.	N.Ob.	
46	Dargamanes										B			1
47	Dargidus	E			F					F	F			4
48	Djihoun	A		A		A			A	A		A	A	7
49	Dosaron		F			F								2
50	Draco	BC										C		2
51	Drahonus					C								1
52	Dyras										F	F		2
53	Eosphoros	BC	BC		C	C			BC	BC	C	C	C	9
54	Erannoboas						A							1
55	Erebus	D			E									2
56	Escol					C								1
57	Eumenides	BC		D	CD					D		D	D	6
58	Euphrates		F							A			A	3
59	Euripas	F			EF		F			F				4
60	Fortuna				BC					C				2
61	Ganges	B	B		B				B		B	B	B	7
62	Garrhuanus		B	A		AB			A		A	AB	B	6
63	Gelbes									D	D			2
64	Gehon	A								A			A	3
65	Gigas				BCD							CD		2
66	Glaucus	C				C	B			B	B	C	BC	7
67	Glesus		E			E					E	E		4
68	Gorgon												C	1
69	Helisson		E			E		E	E			EF		5
70	Helorus								B				B	2
71	Hephaestus												E	1
72	Hiddekel		F									A		2
73	Hyblaeus		E										E	2
74	Hypsa				D			E			D	F	E	5
75	Hyscus					D					D	C	C	4
76	Indus		B		B	A				B	A		B	6
77	Iris											C		1
78	Jala								A					1
79	Jamuna					AB			B	B	B			4
80	Jatrus		C				C							2
81	Kanah	A		A	A	AB	A		A	A		AB	B	9
82	Kedron											C		1
83	Labotas					A				A	A		A	4
84	Laestrigon	DE			E	D	D			D	DE	E	DE	8
85	Laus					E								1
86	Leontes		E			E					E			3
87	Lethes				F							E		2
88	Libicum					F							E	2
89	Malva			D		CD							D	3
90	Nar	E								E				2
91	Nectar	BC	B		BC	B	B		B	BC	BC	BC	BC	10
92	Nepenthes	EF	EF		EF	EF	F	E	EF	EF	EF	EF	EF	10
93	Neudros			A		A					A	AB	A	5
94	Nilokeras					B				B				2
95	Nilosyrtis	F	F		F	F	F				F	F	F	8
96	Nilotis	F	F		F	F	F				F	F	F	8
97	Nus	DEF	EF		E	EF	F	E	EF	E	E	EF	E	10
98	Oescus		E			DE					D			3
99	Orcus					E				D	E		D	4
100	Orontes	A							A	A	A			4
101	Orosines		F								EF	F		3
102	Orpheus	C							C					2
103	Oxus						A				A			2

Fig. 37
Antoniadi 178° D

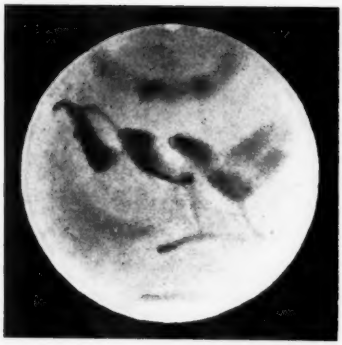


Fig. 38
Peek 199° D

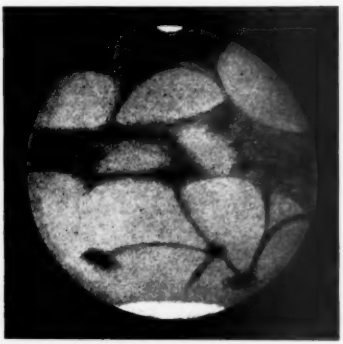


Fig. 41
Ellison$_2$ 237° E

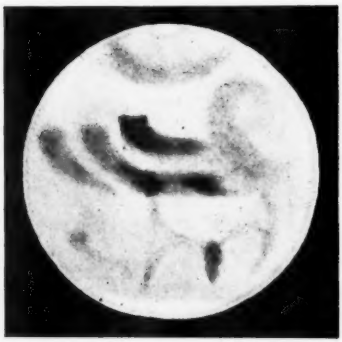


Fig. 42
Peek 237° E

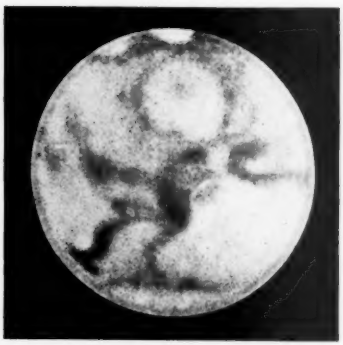


Fig. 45
Antoniadi 292° F

Fig. 46
Peek 284° F

DRAWINGS OF MARS IN 1926.

PLATE XXII

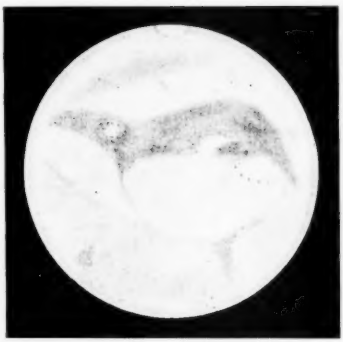


Fig. 39
Attkins 190° D

Fig. 40
Wilson 181° D

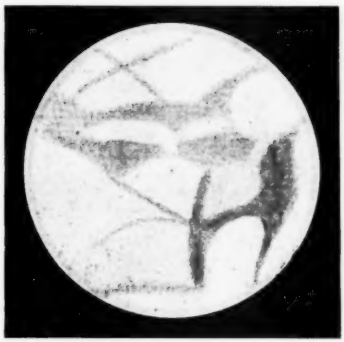


Fig. 43
Attkins 255° E

Fig. 44
Wilson 244° E

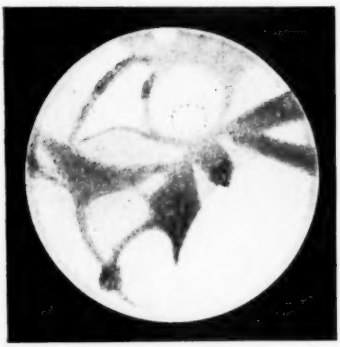


Fig. 47
Attkins 276° F

Fig. 48
Wilson 3[illegible]0° F

DRAWINGS OF MARS IN 1926.

TABLE II.—CONTINUED.

CANALS IDENTIFIED IN THE DRAWINGS.

No.	Canal	Ph.	E_3.	H.	Pk.	T.	Ad.	E_2.	Pe.	Ak.	W.	D.	N.Ob.
104	Pactolus	DE	E		DE	E		E	D	E		E	8
105	Peneus	F										F	2
106	Phasis	C	C			C						BC	C 5
107	Phison	A		A		F			A	A		F	A 7
108	Phryxus						B						1
109	Pingus				B				C	C	C	B	5
110	Plutus				D						CD	C	3
111	Psychrus										D		C 2
112	Pyretus					EF				F	E		3
113	Rha	EF	EF		E	EF	F		F	E		F	8
114	Rhesus						F						1
115	Saeprus						F			F	F		3
116	Sambus	AF	F	A	F	AF			A	A	A	AF	A 9
117	Saus	C	C		CD	CD							4
118	Scamander				E		D			E			D 4
119	Sindus									D			1
120	Sirenius		C										C 2
121	Stachir											D	1
122	Steropes						D				CD	D	D 4
123	Styx	DE	E		DE	D				D			DE 6
124	Tartarus	CD			D	D	C				D		5
125	Thermodon				D								1
126	Thoth	EF	EF		EF	EF	F	E	EF	EF	E	EF	EF 10
127	Triton					EF	F	E	EF		EF		F 5
128	Typhonius	AF		A					AF	A			4
129	Uranius				B								1
130	Vitis						B				C		C 3
131	Xanthus	E			E	E				E		E	E 6
132	13											B	1
133	14	BC				B			B			B	B 5
134	15										B		1
135	531		B						B			B	3
136	534	A		A	A					A		A	5
137	537					B						B	2
138	540	B											1
139	543					A							1
140	547	BC	B		BC	B			BC		B	BC	7
141	563					A							1
142	565					B							1
143	569					C							1
144	581					C							1
145	583		C		C	CD						C	4
146	585											D	1
147	594					D							1
148	602	C	C				C						3
149	609									E			1
150	611		C			C	C				E	DE	5
151	619					D							1
152	624	E	E	D	D	E		E				F	6
153	628		E			E					E		3
154	639					E					EF	E	3
155	640		E								E		2
156	642					EF					F		2
157	644					E	F						2
158	647					F							1
159	649	EF	EF			F			F		F		5
160	651	E	EF			EF	F			EF		F	6
161	655		F			F							2

TABLE II.—CONTINUED.

CANALS IDENTIFIED IN THE DRAWINGS.

No.	Canal	Ph.	E_2.	H.	Pk.	T.	Ad.	E_2.	Pe.	Ak.	W.	D.	N.	Ob.
162	663	F			F	F	F		F			F		6
163	664					F					F	F		3
164	666	F	F			F	F		F					5
165	667				F	F								2
166	670		F		F	F	F		F	F	F	F	F	9
167	671	F	F			F					F			4
168	674						F							1
169	690									A				1
170	704	C	C		C					C	C	C		6
171	A	E	E		E	E		E	E		E	E		8
172	B										A	A		2
173	C	AB	B		A	A	AB		A	A	AB	AB	B	10
174	D					A								1
175	E			D										1
176	F			A							A	A	A	4
177	G	A				A								2
178	H					CD								1
179	I					A								1
180	J								E		E			2
181	K					CD								1
182	L					D								1
183	M					C								1
184	N					D								1
185	O	E	E		E	E		E	DE	E	E	EF	E	10
186	P		E			F	F							3
187	Q										D			1
188	R		E		E			E		EF		F		5
189	S					F								1

Information regarding the number of canals recorded by each observer is contained in Table III. In this table it was found necessary to combine the work of $Ellison_3$ and Hargreaves, the latter having furnished two of the six drawings forming the set. A similar combination

TABLE III.

THE NUMBER OF CANALS RECORDED.

Obs.	Ph	E_3H	Pk	T	AdE_2	Pe	Ak	W	D	N	Total
10	8	8	8	8	8	8	8	8	8	8	8
9	6	7	7	7	5	4	7	6	7	7	7
8	6	5	6	6	6	3	3	4	6	3	6
7	7	6	4	6	1	5	3	4	7	6	7
6	9	11	8	12	5	4	8	8	11	8	14
5	7	8	6	13	9	7	6	9	12	7	16
4	8	8	8	13	3	3	9	13	10	6	21
3	4	12	3	12	6	4	7	14	7	9	26
2	6	8	7	11	4	3	5	9	8	7	34
1	1	1	2	21	7	2	4	4	6	2	50
Totals	62	74	59	109	54	43	60	79	82	63	189
Confirmed	61	73	57	88	47	41	56	75	76	61	139
Order	5	4	7	1	9	10	8	3	2	6	...
Aperture	8,12	10	10	36	33	12	8.5	11	13	13	...
L or M	L, M	L	M	L	L	M	M	M	M	M	...

Obs.	Ph	E_3	H	Pk	T	Ad	E_2	Pe	Ak	W	D	N
Percent	2	0	5	3	19	15	0	5	7	5	7	3

is made of the work of Antoniadi and Ellison$_2$, the latter having furnished one of the drawings. In the first column the canals are divided into groups according to their visibility as determined by the number of observers who recorded them. Thus all of the 10 sets of drawings show eight of the canals. Each one of these eight canals may therefore be described as being of visibility 10. The last column gives the total number of canals in each of the ten groups. As has been noticed in other years these numbers first diminish and then rapidly increase. To make the contents of the table a little clearer, we see for example by the fifth column that the fourth set of drawings which was furnished by Trumpler shows 12 canals in group 6, the total number contained in that group being 14. Douglass was the only observer who drew all of the 28 most readily visible canals, contained in the first four groups. Trumpler won by only one over him in the first six groups, and by only 12 in the whole confirmed series, which is rather striking when we have to compare a 36-inch lens with a mirror stopped down to 13 inches. Douglass uses an open tube. This probably could not be done with the Lick telescope, but it might be possible to get rid of the cold air currents within the tube by means of an electric fan or blower. There can be but little doubt that the air at the upper end of the tube is colder and denser than that near the bottom. That could at least be tried by thermometers. With my 10-foot tube the difference when I am not using the fan is from 1° to 2° Fahrenheit.

Following the ten groups the horizontal line of numbers marked Totals gives the total number of canals seen by each observer. Subtracting from these the numbers in the line above gives the total number of Confirmed canals by which we judge the set. Thus of Trumpler's 109 canals only 88 were confirmed by one or more of the other observers. Since he saw 17 per cent more confirmed canals than any one else, many of his 21 unconfirmed canals were doubtless real, and would have been confirmed had some other observer seen the planet equally well. If we had had the 11-inch Harvard refractor in Jamaica, with which Hamilton saw the same number of confirmed canals as Trumpler in 1924, doubtless many of his 21 unconfirmed canals would have been recorded as confirmed here. This refractor was returned to Harvard University at their request in 1925. The ten sets are ranked in the order of their confirmed canals in the next line. When two observers have the same number, as Phillips and Nakamura, preference is given to the observer having the smaller number of unconfirmed canals. The next two lines give the apertures of the telescopes employed,and a letter to indicate whether the instrument was furnished with a lens or a mirror. In the last two lines each of the twelve observers has a separate column, and the percentage of unconfirmed canals in his drawings is given. This percentage, except in the case of Trumpler perhaps, gives an idea of how indistinct a marking as seen in his telescope the observer would be willing to accept, and record as a genuine canal. It also indicates how far he was straining to record all the canals he could possibly

see. In general the smaller the percentage, the more reliable the observations will be of any unusual marking that he may record. Too much weight must not be given to these figures, however. Thus Douglass specializes on canals in the dark regions, which many observers find rather difficult to see. Peek records only two unconfirmed canals and Hargreaves only one. These numbers are obviously too small to give a reliable indication of the value of their work. Even four unconfirmed canals out of sixty or eighty is by no means a bad result, but merely suggests that care should be taken to draw only that which is certainly seen. In this connection it may be remarked that the only observers every one of whose canals was confirmed were the two Ellisons. Finally it must be remarked that the fact that a canal is not confirmed does not prove that it did not exist when drawn, for it is quite possible that no other observer was looking at the planet under favorable conditions when that particular canal was visible.

In Table IV the arrangement is similar to that in Table III, except that instead of giving the total number of canals seen by each observer, it gives the proportion of the total number recorded. These total numbers are given in the last column, and are taken directly from Table

TABLE IV.

Proportion of the Canals Visible to the Different Observers.

Obs.	Ph	E_3H	Pk	T	AdE_2	Pe	Ak	W	D	N	Total
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8
9	.86	1.00	1.00	1.00	.71	.57	1.00	.86	1.00	1.00	7
8	1.00	.83	1.00	1.00	1.00	.50	.50	.67	1.00	.50	6
7	1.00	.86	.57	.86	.14	.71	.43	.57	1.00	.86	7
6	.64	.79	.57	.86	.36	.29	.57	.57	.79	.57	14
5	.44	.50	.38	.81	.56	.44	.38	.56	.75	.44	16
4	.38	.38	.38	.62	.14	.14	.43	.62	.48	.29	21
3	.15	.46	.12	.46	.23	.15	.27	.54	.27	.35	26
2	.18	.24	.21	.32	.12	.09	.15	.27	.24	.21	34
1	.02	.02	.04	.42	.14	.04	.08	.08	.12	.04	50
Confirmed	.44	.52	.41	.63	.34	.29	.40	.54	.55	.44	1.00

III. The ideal observation would show the fractional proportions decreasing continuously. The last horizontal line of the table shows the proportion of confirmed canals that each observer contributed to the final result. It is deduced from the row of Table III marked Confirmed. The three remaining tables which pertain to the lakes are arranged exactly like their predecessors. Those designations indicated by numerals are given by the writer. A comparison of the last lines of Tables III and VI is instructive as indicating the characteristics of the work of some of the observers. Thus Phillips and $Ellison_2$, while extremely cautious about putting down what appeared to them to be doubtful canals, appear to have been less so with regard to the lakes, and to have put too much faith in fleeting impressions of this character. Hargreaves' drawings being merely supplementary to those of Ellison, and but two in number, showed only 8 lakes. One of these was unconfirmed, but

this obviously gives us and him no reliable information regarding his work. Trumpler again leads in unconfirmed percentage, but this time his confirmed lakes exceed in numbers very little those seen by Antoniadi, Phillips, and Wilson. In fact these observers may all four be

TABLE V.

LAKES IDENTIFIED IN THE DRAWINGS.

Lake	Ph.	E_3.	H.	Pk.	T.	Ad.	E_2.	Pe.	Ak.	W.	D.	N.Ob.
Apollinaris	C		D	D						D		4
Auri	B							A		B		3
Ascraeus	B			B					C			3
Acube		E				D				D		3
Bandusia						C				CD		2
Charontis	DE	E	D	DE	DE	CD	E	DE	D	DE	E	D 10
Cranon					D	D		D				3
Cyclopium	E											1
Cynia	E									E		2
Casuentus					F						F	2
Deltodon	F				F	F			F			4
Dirce						A						1
Drepsa					C			CD				2
Dium	E				D			D				3
Eleon						D				D		2
Ferentini									C			1
Gomer	E	E								E		E 4
Gordii				D								1
Hesperidum										F		F 2
Immortalis										E		1
Isos	C											1
Juturna									A	A		2
Juventae					B	B		B		B	B	B 6
Lunae	B			B	B	B		B				5
Lucrinus		E										D 2
Margaritifer	A				AB			A				A 4
Maesia	BC				B	B				B		B 5
Maricae										D		1
Messeis											B	1
Moeris	EF							F		EF		EF 4
Niliacus				B	A				AB	B		4
Nilus	F											1
Nitriae									CD			1
Nuba	E					F						2
Phoenix	BC	BC				BC		C	C	C	B	BC 8
Pudnu					C	C						2
Pseboas						F						1
Pnups					F							1
Regina					AF	F						2
Sirbonis						F			A			2
Triton	EF						E	F	F	E	E	E 7
Utopia			D							D		2
Zur					F							1
2										B		1
3	BC			C	BC			B		BC	C	BC 7
7										BC		BC 2
8	B				B	B		B				4
101	AF				F	F					F	4
102	A								B			2
103	A			A				A				B 4
104	A					A		B				3
105	BC				B	B				BC	B	B 6

TABLE V.—CONTINUED.

LAKES IDENTIFIED IN THE DRAWINGS.

Lake	Ph.	E_3.	H.	Pk.	T.	Ad.	E_2.	Pe.	Ak.	W.	D.	N.Ob.
106	A			B	B			B				4
107					A							1
108					AB							1
109	A				A							2
110						A			A	A		A 4
111				B	B	B				BC		B 5
112					A	A						2
113				A		A						2
114												C 1
115					B							1
116						B						1
117	C			B				B		C		4
118	BC			B								B 3
119						B						1
120										B		1
121	C					C				C		C 4
122					CD	CD		C				3
123					CD	C		C				3
124	CD				CD	C					C	4
125					D	C						2
126					CD	C						2
127					CD			C				2
128												C 1
129			D	D	D	D		D	D	D		D 8
130			D							D		2
131			D							D		2
132			D									1
133					D							1
134	E			E								2
135					D							1
136						D						1
137	F									F		2
138	DE	E		E	E		E			E		E 7
139										F		1
140	E				E	E				F		4
141	EF				F	F						3
142										E		1
143	E											1
144	EF					F						2
145					CD	CD						2
146		E										1
147	F											1
148					E							1
149	F											1
150	A	F	A		F							4
151		F										1
152					F							F 2
153					F							1
154					F							1
155					F							1
156					F					F		2
157					F						F	2
158					F							1
159												A 1
160						F				F		2
161						F						1
162										F		1
163					B					A		2

TABLE VI.

THE NUMBER OF LAKES RECORDED.

Obs.	Ph	E_3H	Pk	T	AdE_2	Pe	Ak	W	D	N	Total
10	1	1	1	1	1	1	1	1	1	1	1
9	..	..	..	..	..	..	..	..	..	..	0
8	1	2	1	1	2	2	2	2	1	2	2
7	3	1	2	2	2	2	1	3	2	3	3
6	1	0	0	2	2	1	0	2	2	2	2
5	2	0	2	3	3	1	0	2	0	2	3
4	13	2	5	8	7	6	3	8	2	6	15
3	7	2	2	6	6	6	1	2	0	1	11
2	7	4	2	14	13	2	3	13	2	4	32
1	6	3	1	12	6	0	2	7	1	3	41
Totals	41	15	16	49	42	21	13	40	11	24	110
Confirmed	35	12	15	37	36	21	11	33	10	21	69
Order	3	8	7	1	2	5	9	4	10	6	...
Aperture	8, 12	10	10	36	33	12	8.5	11	13	13	...
L or M	L, M	L	M	L	L	M	M	M	M	M	...

Obs.	Ph	E_3	H	Pk	T	Ad	E_2	Pe	Ak	W	D	N
Percent	15	22	12	6	24	15	0	0	15	18	9	12

TABLE VII.

PROPORTION OF THE LAKES VISIBLE TO THE DIFFERENT OBSERVERS.

Obs.	Ph	E_3H	Pk	T	AdE_2	Pe	Ak	W	D	N	Total
10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1
9	...	...	...	...	...	...	...	...	...	...	0
8	.50	1.00	.50	.50	1.00	1.00	1.00	1.00	.50	1.00	2
7	1.00	.33	.67	.67	.67	.67	.33	1.00	.67	1.00	3
6	.50	.00	.00	1.00	1.00	.50	.00	1.00	1.00	1.00	2
5	.67	.00	.67	1.00	1.00	.33	.00	.67	.00	.67	3
4	.87	.13	.33	.53	.47	.40	.20	.53	.13	.40	15
3	.64	.18	.18	.27	.27	.27	.09	.18	.00	.09	11
2	.22	.12	.06	.44	.41	.06	.09	.41	.06	.12	32
1	.15	.07	.02	.29	.15	.00	.05	.17	.02	.07	41
Confirmed	.51	.17	.22	.54	.52	.30	.16	.48	.14	.30	1.00

properly placed in one group. Since one-quarter of Trumpler's lakes are unconfirmed by others, it looks as if he were straining too much to exceed in numbers.

Antoniadi's is a very singular case. In our Report No. **35** (POPULAR ASTRONOMY, 1926, **34**, 289) we found that he could see very few confirmed canals compared to other observers, much fewer for example than Wilson, who used an 11-inch reflector against Antoniadi's 33-inch refractor. The few that Antoniadi did see were all confirmed, but he missed four canals that were seen by 4, 5, 6, and 7 other observers out of the 8 whose drawings were considered. With regard to the lakes he saw 23 in the region under discussion at that time, while no other observer saw more than 14. But 13 of these latter were confirmed by other observers, and only 12 of Antoniadi's. Hamilton, who secured this result, used the 11-inch Harvard refractor. Antoniadi's caution with regard to the canals was certainly not shown with regard to the lakes. This year he lost his former caution with regard to the canals

also, as we see by the lower line of Table III, and even then made no better showing than before, since with the aid of $Ellison_2$, who contributed one drawing out of the six, and saw 12 confirmed canals, Antoniadi and Ellison combined saw only 47 that were confirmed, and seven of these were contributed by Ellison alone. On the other hand, Attkins with an 8.5-inch reflector saw 56 canals that were confirmed by other observers. Probably if Antoniadi had cut his aperture down to 12 or 15 inches, as was done by Lowell, by Douglass, and by Jarry-Desloges, he would have seen more canals. With the lakes, however, this year he did very much better. Indeed I think he may fairly be said to head the list, for although Trumpler saw one more that was confirmed, yet he saw 12 unconfirmed lakes while Antoniadi saw only 6. Nearly all of the observers saw a larger proportion of unconfirmed lakes than they did of unconfirmed canals, which points the moral that more caution is needed when recording what we believe to be a lake. The chief sinners, those having 15 or more per cent of unconfirmed lakes, were in general those who saw the largest number, and who, I believe, strained too much in order to lead.

With regard now to the facility with which different observers are able to see canals and lakes, let us take the two extreme cases of Antoniadi and Douglass. Turning to Tables III and VI, we find by the line marked Order that for canals Douglass ranks 2, and Antoniadi 9. For lakes their positions are reversed, Antoniadi ranking 2, and Douglass 10. In the unconfirmed percentages Douglass makes much the better showing, for canals 7 to Antoniadi's 15, and for lakes 9 to again Antoniadi's 15. My impression is that Douglass does not look persistently enough for the lakes. There is no question, however, but that Antoniadi has looked hard enough this year for the canals, with so large a percentage as 15 that were unconfirmed. There are three possible reasons for his failing to detect what to other observers are comparatively so easy. It is either the fault of his eye, of his telescope, or of his seeing. When he was a young man he even doubled the canals with Schiaparelli. This might lead us to believe that his eyesight was now at fault, and possibly astigmatic. On the other hand his fellow observer M. Baldet, presumably a younger man, seems to have seen just about what Antoniadi did. If it is the fault of the seeing, or due to excessive air currents in the telescope, it is surprising that he should have succeeded in doing so well with the lakes. His explanation in 1924 was that the canals he could not see were not there (see Report No. **35**) and he unfortunately criticized severely not only Schiaparelli, but also Lowell and Trumpler for seeing them. Peek and Attkins are two other observers, living not far apart, but whose capacities for seeing canals and lakes are rather unequal. By Tables III and VI we find that the former saw 41 confirmed canals to Attkins' 56, but that he saw 21 confirmed lakes to Attkins' 11. He had a somewhat larger mirror.

PLATE XXIII

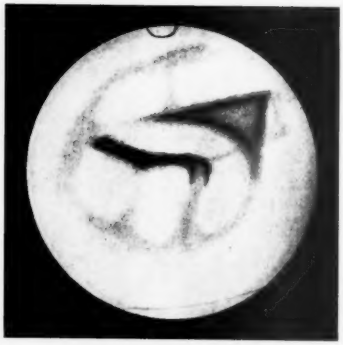


Fig. 49
Douglass 347° A

Fig. 50
Nakamura 3° A

Fig. 51
Douglass 61° B

Fig. 52
Nakamura 57° B

Fig. 53
Douglass 114° C

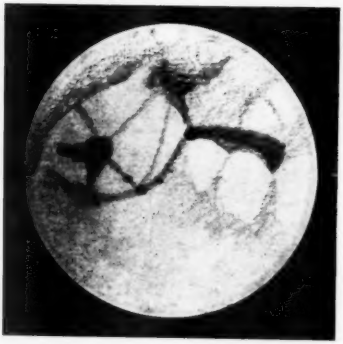


Fig. 54
Nakamura 124° C

DRAWINGS OF MARS IN 1926.

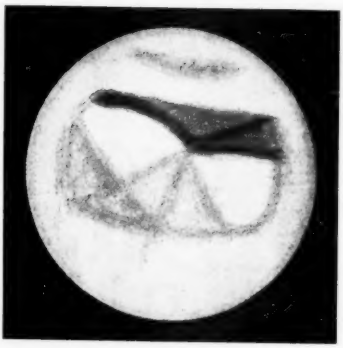


Fig. 55
Douglass 167° D

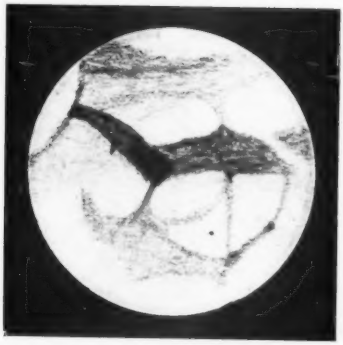


Fig. 56
Nakamura 178° D

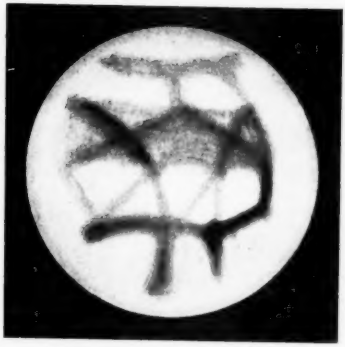


Fig. 57
Douglass 236° E

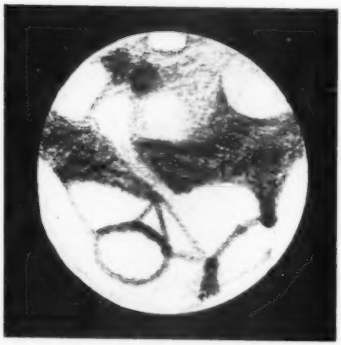


Fig. 58
Nakamura 238° E

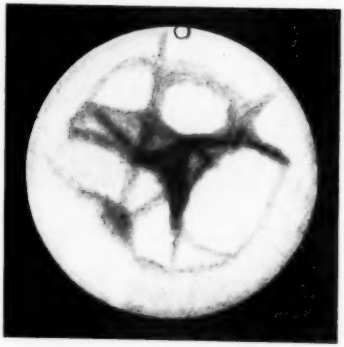


Fig. 59
Douglass 287° F

Fig. 60
Nakamura 302° F

DRAWINGS OF MARS IN 1926.

THE APPARITION OF 1928.

This apparition will probably go down in history as the worst observed apparition of modern times. Clouds covered the skies much of the time both in England and in Jamaica, and when the clouds were not there the seeing, in Jamaica at least, was atrocious. The same complaint comes from Japan, and Douglass writes that he had to be away from his observatory during the better part of the apparition. Wilson also speaks of almost continuous bad weather, although that is not unexpected in our southern states at that season of the year. I had thought of closing the series of drawings with this number, but as the various observers seem rather modest about sending in their work this year, and as I rather fear that, if they don't send it to me, they may not publish it at all, leaving future astronomers to wonder what did happen on Mars in 1928-1929, it seemed to me to be on the whole a particularly poor year to quit. I have in consequence decided to issue a call to all observers who saw anything at all worth publishing, to finish their six drawings of the planet, and send them in as soon as possible.

PRIVATE OBSERVATORY, MANDEVILLE, JAMAICA, B. W. I., AUGUST 20, 1929.

AMERICAN ASTRONOMICAL SOCIETY.

ABSTRACTS OF PAPERS

ON THE NATURE OF WOLF-RAYET EMISSION.

BY C. S. BEALS.

Measurements of the width of Wolf-Rayet bands indicate that bands due to a given atom have widths approximately proportional to their wave-lengths. This is in accordance with the idea that the breadth of Wolf-Rayet bands is due to motion of the emitting gases in the line of sight. Such motion could be produced by the action of selective radiation pressure causing the continuous ejection of high-speed atoms from a star in the manner suggested by the theoretical work of E. A. Milne and M. C. Johnson.

This theory is obviously similar to accepted ideas of nova emission and is rendered probable by the fact that Wolf-Rayet stars are similar to novae in the following respects: (a) the strength of the bands relative to the continuous spectrum, (b) the undisplaced positions of the centers of bands, (c) the order of band-widths observed and the variation of band-width with wave-length, and (d) the appearance of absorption on the violet edges of bands. There is the further consideration that old novae have, in some cases, been shown to be typical Wolf-Rayet stars.

The loss of mass which a star may sustain, due to the ejection of stellar material, has been calculated first for a dwarf star of mass and radius equal to those of the sun and, secondly, for a giant star of mass thirty times that of the sun and 10^8 km radius. Assuming a velocity of

2000 km/sec and a density of 3×10^{-17} (that given by Milne for the solar chromosphere), the fraction of mass lost per year is 6×10^{-12} for the dwarf and 4×10^{-9} for the giant star. This rate of diminution of mass would scarcely appear to be rapid enough to negative the theory.

The spectra of P Cygni and η Carinae, former novae, exhibit the phenomenon of absorption on the violet edges of emission lines and, though there is no information available as to the width of emission lines of η Carinae, those of P Cygni have been shown to increase in width with wave-length. There seems some reason, therefore, to suppose that the peculiarities of these spectra and of other stars showing the P Cygni characteristics are due to the continuous ejection of gaseous material from the star in a manner similar to that suggested to explain Wolf-Rayet spectra.

THE ORBIT OF JUPITER'S EIGHTH SATELLITE: COMPLETION OF THE FIRST STAGE.

By E. W. Brown.

Professor Brown's paper consisted of a brief general account of the work which had been done towards the computation of the orbit of this satellite. The difficulties due to its long period, high excentricity, and large inclination were pointed out, and it was mentioned that the work is being continued, with the hope of reaching results which can be compared with observation in the course of a year.

SPECTRUM VARIABLES OF CLASS Be.

By R. H. Curtiss.

Variability appears to be a characteristic which prevails among spectra of Class Be. The most conspicuous variation is usually a change in the relative intensity of the two components into which the hydrogen emission lines are in many cases divided by central absorption. These variations may be periodic, or irregular, or progressive. In the two latter cases it may follow that the period is long and awaits discovery. Like the Omicron Ceti light-variables, the long-period spectrum-variables of Class Be appear not to repeat their changes accurately from cycle to cycle and seem to merge with irregular types.

The purpose of the present paper is to present for the benefit of other observers the more recent results on several of these stars which are being followed at Ann Arbor.

H. D. 20336 (H R 985), $3^h\,11^m.2$. The latest Ann Arbor period is 1710 days. This is one of the more regular of these variables. The curve for this star is approximately a sine curve.

Pleione, $3^h\,43^m.3$. Observations of Pleione to 1927 show no return of emission.

25 Orionis, $5^h\,19^m.5$. The latest Ann Arbor period is 1890 days. The curve is approximately a sine curve.

Zeta Tauri, $5^h\,31^m.7$. The long variation period is now predicted to be about 30 years.

Kappa Draconis. In this case the emission components vary approx-

imately together referred to the neighboring continuous spectrum. The hydrogen emission was relatively strong in 1915, 1920, and 1927, and weak in 1912, 1921, and 1928. The observations permit of periods of 2000 days or 4000 days with a possibility of double periodicity. Other features than hydrogen emission are variable.

b_2 Cygni, $20^h\,5^m7$. The variations of the emission lines are irregular. The period of 1370 days previously adopted does not hold. Velocity variations of shorter periods are observed.

f^1 Cygni, $20^h\,56^m4$. This must now be regarded as an irregular variable and not of the class like Pleione which have lost their emission. The hydrogen emission was strong in 1904. Thereafter it faded and reached a minimum in 1918 when it was invisible in the photographic region. It was returning in 1923 and was well marked in 1927. In 1928 it was less marked and at present has developed a marked asymmetry with the violet component the stronger. If a period exists it is long—possibly 25 or 30 years in duration.

Upsilon Cygni, $21^h\,13^m8$. The variation is small. The period of 1800 days previously derived is still on trial.

Omicron Aquarii, $21^h\,58^m1$. Period still uncertain but appears to be in the neighborhood of 2500 days.

Pi Aquarii, $22^h\,20^m2$. The variation is pronounced. The period now indicated is 2700 days.

GRADUATED SPHERE AND COÖRDINATE FRAME FOR READING HELIOGRAPHIC POSITIONS.

By R. E. DeLury.

A sphere graduated in latitude and longitude is mounted on an axis through its equator, resting in a plane corresponding to the plane at right angles to the radius vector through the center of the sun, and by means of a friction handle the sphere is rotated to correspond to the "latitude of the center of the solar disc" at the time of an observation. A graduated position-circle ring rests in this plane, and on it is mounted a rectangular coördinate frame whose planes, cut to fit down on the sphere, are graduated in millimeters. This is set at the position-angle of the observation, and the millimeter readings on the planes corresponding to the various points on the solar disc, observed at one time spectroscopically, point to the respective heliographic latitudes and longitudes, which are read off directly at a great saving of computation. In order to read accurately the positions of points near the limb of the sun, bevelled plates with rulings corresponding to the outer millimeter graduations are mounted on the frame. It is planned to use the sphere also with a vertical enlarger for focussing an image of a solar photograph to the same diameter as the sphere on a disc resting on the coördinate frame, so that heliographic positions of sunspots may be read.

BEHAVIOR OF CYANOGEN IN THREE VARIABLE STARS.

By A. Vibert Douglas.

Doubt having been cast on the nature of the cyanogen band at $\lambda 4200$ by the suggestion that it was wholly or in part due to glass absorption, its behavior has been studied relative to the spectrum changes with phase in the variables Eta Aquilae, RT Aurigae, and Alpha Ursae Minoris.

In each case there is distinct variation in intensity with phase pointing to the stellar origin of the band. The curves, however, agree more nearly with the ionization and $H\gamma$ variations than with the variations of intensity of the G band. Evidence is given against the supposition that the $\lambda 4200$ band is a spurious band arising from the overlapping of the wings of adjacent arc and spark lines.

A STUDY OF Y CYGNI.

By R. S. Dugan.

Photometric observations accumulated during the last fourteen years have been reduced to phase by means of the curves of variation of period in *H.B.* 856. The smoothness of the mean curve testifies to the accuracy of these curves. The radii are approximately 6.0 ⊙ and 5.8 ⊙; the masses 16.9 ⊙, 16.2 ⊙; and the densities 0.075, 0.085. The two stars are very closely of equal surface brightness. A complete discussion will appear in *Contributions, P.U.O.*

THE NEBULOUS WREATH NEAR ε CYGNI.

By J. C. Duncan.

The nebulae N.G.C. 6960 and 6992 and the faint, uncatalogued nebulosity which, lying a little farther north, unites them into a wreath, are shown on photographs made with the 100-inch Hooker reflector with its aperture diaphragmed down to 84 inches in order to extend the field of good definition. The photograph of N.G.C. 6960 was made August 3, 1921, with an exposure of 7 hours; that of N.G.C. 6992 on August 15, 1928, exposure 6½ hours; and that of the uncatalogued nebulosity on August 9 and 10, 1929, exposure 9 hours. The nebulosity is all of a filamentous character, that on the latest plate being in several unconnected patches. The first and last of the three plates show evidence of obscuring nebulosity.

THE CONTOURS OF HELIUM LINES IN STELLAR SPECTRA.

By C. T. Elvey.

This paper, which will be published in detail in an early number of *Astrophysical Journal*, presents the observed contours of the helium lines $\lambda 4387$ and $\lambda 4471$ in the spectra of 28 stars. The Stark Effect and the rotation of the stars are shown by the contours. The observations are discussed in relation to Milne's theory of absorption lines.

THE ABSORPTION BAND IN STELLAR SPECTRA AT $\lambda 4200$.

By C. T. Elvey and R. S. Zug.

Measurements of the depth and extent of the absorption band at $\lambda 4200$ in stellar spectra have been made. In the spectra of four stars it is found to be about 120 A wide with its center at $\lambda 4195$, and its central intensity is 9 per cent absorption of the continuous spectrum.

To test the amount of the selective absorption in the optical glass, spectra of a 500-watt Mazda lamp were taken which gave the following results for an absorption band of the same position and extent as the one in stellar spectra. Each of the observations contains any absorption that may be due to the glass of the electric light bulb. The designations I-prism and II-prism refer to the Bruce spectrograph with one or two prisms, and I_0 is the central intensity of the band.

I-prism, 40-inch objective and correcting lens, gives I_0 equal to 19 per cent.

I-prism spectrograph only, I_0 is 8 per cent.

II-prism, 40-inch objective and correcting lens, I_0 is 18 per cent.

This shows that there is no absorption band in the prisms which are of glass O 102, and also, that the residual absorption in the 40-inch objective and correcting lens is greater than in the stellar spectra. Since the light of the lamp traverses the optical axis of the system the discrepancy indicates that a large part of the absorption is in the crown (convex) lens. This is shown better by some spectrograms which were taken of Vega with the objective diaphragmed to an aperture of 10 inches and others with the light of the star coming through the outer 5 inches of the objective. The central rays gave an absorption band with a depth of 12 to 13 per cent and the peripheral rays gave 5 to 6 per cent.

We were able to obtain the absorption of one of the elements of the system, namely, the crown lens of the 40-inch objective, by placing the spectrograph in front of the objective and a mirror between the crown and flint components. Thus, we were able to obtain the absorption due to the double thickness 4¾ inches of the center of the crown lens. The absorption is 11 per cent and the control plates (spectrograph, lamp, and mirror) gave 6 per cent.

These spectrograms showed the crown lens to have another absorption band with its center at λ4345 and also of a width of about 120 A. Its central intensity was 5 per cent. It did not appear on the control plates.

EXTRA-FOCAL PHOTOMETRY AT THE YERKES OBSERVATORY.

By A. S. Fairley.

This work was begun by Parkhurst in 1908, but has not been carried on for about 15 years.

The instrument used is the 6-inch Zeiss Ultra Violet Camera of 81 cm focal length. Plates are exposed 6 mm inside the focus, and are standardized with a sensitometer and measured in a Hartmann microphotometer. A comparison of results with Mueller and Kempf, Parkhurst, and the Henry Draper Catalogue is given.

TERRESTRIAL MAGNETISM IN CANADA.

By C. A. French.

Magnetic data relating to the Dominion of Canada have been accumulating for over 300 years, though many of the records lack proper correlation.

In 1840 a magnetic observatory was established at Toronto, where it was maintained in operation until 1898, and at Agincourt, some 12 miles distant, since that date. In 1882 another was established at Fort Rae and operated for one year as part of an international coöperative plan for making observations around the magnetic pole. The meteorological service established an observatory in 1916 at Meanook, Alberta.

In 1880 the Topographical Survey began making magnetic observations, operating until quite recently only in Western Canada. Results were thus obtained in places which could otherwise only with difficulty be reached.

The Dominion Observatory in 1907 assumed as one of its functions a magnetic survey of Canada, covering the country with a network of stations to furnish accurate data for the study of the earth's magnetism and at the same time satisfy all the needs of a practical nature.

In addition to obtaining values of the three magnetic elements at each station special attention was given to securing diurnal variation data. From experience gained whilst working in the higher magnetic latitudes it is evident that some portable type of variation instrument with a recording device would be of decided advantage.

The results obtained thus far serve to illustrate the complex nature of the various phenomena such as diurnal and secular change, and magnetic disturbances, and suggest, as has been stated by Rücker, that "For those who would unravel the cause of the mysterious movements of the compass needle, concerted action is essential."

NOTES ON SPECTROSCOPIC BINARIES.

By W. E. Harper.

Twelve binaries determined at Ottawa have been reobserved from time to time with a view to improving the periods. The star h Draconis has a period of 52.11 days, 0.40 greater than originally determined. Minor changes occur in the orbit.

The star H.R. 5472, discovered as a spectroscopic binary at Victoria in 1923, had a period of 101 days and the velocity of its system became more positive by 16.7 km in the years from 1923 to 1928. Apparently it is a triple system.

(To be continued.)

PLANET NOTES FOR JANUARY.

By CLIFFORD E. SMITH.

The *Sun* will be moving northeast from the central part of Sagittarius to the central part of Capricornus. On January 3 the earth will be at perihelion; that is, the earth will be nearest the sun on that date. The position of the sun on January 1 and January 31 will be respectively, R.A. $18^h\ 43^m$, Decl. —23° 5′; and R.A. $20^h\ 51^m$, Decl. —17° 39′.

The phases of the *Moon* will occur as follows:

First Quarter	Jan.	7 at	9 P.M.	C.S.T.
Full Moon		14 "	4 P.M.	"
Last Quarter		21 "	10 A.M.	"
New Moon		29 "	1 P.M.	"

The moon will be at apogee on January 1 and on January 28, and at perigee on January 15.

Mercury will be in western Capricornus most of the month. Its motion will be direct until January 12, thereafter retrograde. On January 6 it will be at greatest elongation east, and about this date it will set about an hour after the sun. On January 22 Mercury will be at inferior conjunction. On January 23 it will be in conjunction with Venus, and on January 28 it will be in conjunction with the moon and with Mars.

Venus will be near the sun in apparent position (conjunction occurring early in February) and thus will be of no interest this month.

Mars will move to the eastern part of Sagittarius. During this period it will be a morning star, rising about an hour before the sun at the end of the month.

Jupiter will be in Taurus about five degrees in a northerly direction from Aldebaran. During the first part of the month it will be on the meridian about 9:00 P.M. Standard Time. On January 11 it will be in conjunction with the moon. Its motion during the month will be direct.

Saturn will be a morning star in western Sagittarius during this period. At the end of the month it will rise about two hours before the sun.

Uranus will be in central Pisces, which will be in the evening sky. During the middle of the month it will set about 11:00 P.M. Standard Time. On January 7 it will be in conjunction with the moon. Its motion during the month will be direct.

Neptune will be in Leo about five degrees in a southeasterly direction from Regulus. During the middle of the month it will be on the meridian about 3 P.M. Standard Time. On January 17 it will be in conjunction with the moon. Its apparent motion during this period will be retrograde.

OCCULTATIONS.

Prediction of Occultations for Amherst, Mass., and Vicinity.

(Disappearances Only)

The occultations of *k* Tauri on January 12 and 38 Virginis on January 20 will occur near the horizon, at altitudes in the neighborhood of 10°. That of 42 Leonis on January 17 will probably prove to be an approach and actual occultation will not occur.

Date 1930		Star	Mag.	G.C.T. h m	*a* m	*b* m	P °
Jan.	3	161 B. Capricorni	6.4	22 38	—1.8	—1.5	95
	11	14 H.[1] Tauri	6.5	1 30	—0.9	+3.2	16
	11	22 H.[1] Tauri	6.1	3 12	—1.1	—3.6	127
	12	*k* Tauri	5.6	9 21	+0.3	—1.0	87
	15	*ω* Cancri	6.1	0 13	+0.6	+3.6	32
	15	4 Cancri	6.2	0 19	—0.5	+0.9	103
	15	λ Cancri	5.9	9 18	—0.7	—1.5	104
	16	90 H.[1] Cancri	6.1	3 24	—1.2	+4.6	44
	17	42 Leonis	6.1	8 10	...	...	33
	19	10 Virginis	6.2	8 35	—2.4	+0.4	87
	20	38 Virginis	6.1	4 48	—0.4	+0.9	104

The G.C.T. of the occultation at some other station within 300 miles of Amherst may easily be found from the coefficients *a* and *b* and the formula

$$\text{G.C.T.} = \text{Predicted G.C.T.} + a\Delta\lambda + b\Delta\phi,$$

where $\Delta\lambda$ is equal to the longitude of the place (to tenths of a degree) minus the longitude of Amherst (72.5 degrees) and $\Delta\phi$ is equal to the latitude of the place (likewise to tenths of a degree) minus the latitude of Amherst (42.2 degrees). For distances up to 300 miles the error of this formula will rarely exceed 2^m.

ROY MARSHALL.

Detroit Observatory, Ann Arbor, Michigan.

Occultations Visible at Washington.

[From the *American Ephemeris.*]

Date 1930		Star's Name	Magnitude	IMMERSION Washington C.T. h m	IMMERSION Angle from N °	EMERSION Washington C.T. h m	EMERSION Angle from N °	Duration h m
Jan.	3	161 B. Capricorni	6.4	17 26	98	18 23	195	0 57
	10	14 H.[1] Tauri	6.5	20 7	24	21 10	282	1 2
	12	*k* Tauri	5.6	4 18	101	5 6	254	0 48
	14	*ω* Cancri	6.1	18 56	41	19 32	324	0 36
	14	4 Cancri	6.2	19 7	108	20 4	258	0 57
	15	λ Cancri	5.9	4 13	118	5 12	286	0 59
	15	90 H.[1] Cancri	6.1	22 0	64	22 51	329	0 51
	17	42 Leonis	6.1	2 33	77	3 23	352	0 50
	18	*b* Virginis	5.2	21 39	43	21 54	8	0 16
	19	10 Virginis	6.2	3 17	108	4 28	333	1 12
	19	38 Virginis	6.1	23 36	119	0 38	304	1 1

VARIABLE STARS.

Monthly Report of the American Association of Variable Star Observers, for the Month of October, 1929.

The recent meeting of the Association at Harvard was replete with evidences of earnest enthusiasm. From the start on Friday evening, October 18, when Dr. Clyde Fisher lectured before an Observatory Open Night group on the Zeiss Planetarium, to the finish on Saturday evening, when retiring President Pickering gave his annual exhibition of slides depicting observatories and astronomers —both amateur and professional—encountered in connection with the visit to this country of Dr. W. H. Steavenson, the meeting never experienced a dull moment. Not only was the attendance large, but the reports read were followed with keen

Variable Star Observations Received During October, 1929.

Aug. 0 = J.D. 2425824; Sept. 0 = J.D. 2425855; Oct. 0 = J.D. 2425885.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
V Scl			**T Cas**			**Y Cep**			**W Cas**			**RZ Per**			**o Cet**		
000339			001755			003179			004958			012350			*021403*		
838	9.5	Bl	885	7.5	L	857	9.6	L	896	9.6	BL	883	11.1	Br	831	5.0	Kd
848	9.6	Bl	887	7.2	Pt	858	10.4	Wn	899	10.0	BL	885	11.1	L	857	5.8	Kd
851	9.9	Dr	889	7.7	Jo	866	10.4	L	903	10.1	BL	**RU And**			857	6.3	Ah
859	10.0	Bl	893	7.6	Jo	878	11.1	Sf	**U Tuc**			013238			859	6.2	Ah
865	10.4	Dr	**R And**			885	10.8	L	*005475*			859	11.3	L	859	6.1	Tf
869	10.6	Bl	001838			890	11.6	Wn	828	12.9	Sm	883	11.2	Br	862	5.9	L
878	10.7	Bl	877	12.0	Ch	**U Cas**			831	12.7	Ht	885	11.1	L	863	6.3	Ah
S Scl			885	11.2	Sd	004047a			838	12.5	Bl	887	10.9	Pt	865	6.5	Ah
001032			885	11.6	Mg	852	10.9	Wn	848	11.6	Bl	890	11.8	Wn	867	5.9	Tf
828	10.5	Ht	887	10.6	Pt	857	11.5	L	848	12.0	Ht	**Y And**			869	6.1	Kd
829	10.8	Sm	889	9.8	Wd	866	12.2	L	851	11.8	Dr	013338			872	6.2	Ah
838	9.8	Bl	**S Tuc**			877	12.6	Ch	854	11.8	En	859	9.5	L	873	6.2	Ah
848	9.7	Bl	*001862*			885	12.7	L	859	11.2	Bl	883	10.0	Br	877	6.2	Jo
848	10.3	Ht	825	10.3	Ht	887	13.0	Pt	865	11.1	Dr	885	9.9	L	879	6.0	Jo
851	9.8	Dr	828	11.0	Sm	890	13.0	Wn	869	11.0	Bl	887	10.2	Pt	880	6.4	Ah
854	9.9	En	831	10.6	Ht	**RW And**			878	9.9	Bl	890	10.2	Wn	882	6.6	Kd
859	9.5	Bl	838	11.3	Bl	004132			**Z Cet**			**X Cas**			883	6.7	Ah
865	8.9	Dr	848	12.4	Bl	857	8.2	L	*010102*			014958			884	6.7	L
869	8.4	Bl	848	12.4	Ht	861	8.3	Tf	862	13.7	L	881	12.1	Bn	885	6.8	Tf
878	7.9	Bl	851	12.9	Dr	867	8.2	Tf	885	13.3	L	887	11.8	Pt	887	6.0	Pt
882	7.7	Kd	854	13.2	En	867	8.0	L	**U Scl**			**U Per**			889	7.2	Gv
X And			859	13.4	Bl	879	8.3	Jo	*010630*			015254			892	7.5	Gb
001046			865	13.1	Dr	879	8.4	Ch	838	13.0	Bl	887	9.2	Pt	893	6.7	Jo
856	11.8	Lj	**S Cet**			885	8.3	L	848	13.3	Bl	**S Ari**			894	7.1	Gy
861	11.9	Lj	*001009*			885	8.4	Tf	851	13.5	Dr	015912			**S Per**		
864	11.9	Lj	852	14.5	Wn	887	8.5	Pt	**U And**			857	11.6	L	021558		
870	12.1	Li	862	14.2	L	889	8.0	Jo	010940			885	11.6	L	836	10.0	Kl
877	12.2	Ch	885	13.5	L	**X Scl**			857	13.8	L	**R Ari**			850	10.3	Kl
879	12.6	Lj	**T Scl**			*001435*			883	13.0	Br	021024			856	10.2	Kl
880	12.7	Lj	*002438a*			838	13.7	Bl	**UZ And**			883	13.0	Br	859	9.5	Ah
883	12.8	Lj	851	10.1	Dr	848	13.6	Bl	011041			887	12.4	Pt	865	9.6	Ah
887	12.7	Sd	865	11.2	Dr	**RR And**			859	13.9	L	**W And**			873	9.4	BL
T Cet			**RR Scl**			004533			883	12.8	Br	021143a			879	9.6	BL
001620			*002438b*			857	13.9	L	**S Psc**			883	12.5	Br	880	9.6	Ah
831	6.6	Kd	815	12.7	Dr	**RV Cas**			011208			887	12.4	Pt	882	9.5	Ah
857	6.6	Kd	865	13.0	Dr	004746a			864	13.9	L	**T Per**			883	9.5	Ah
859	6.4	Tf	**T Phe**			858	15.4	Wn	885	14.5	L	021258			883	9.6	BL
860	6.5	L	*002546*			882	13.9	Br	**S Cas**			859	8.8	Ah	887	9.4	Pt
867	6.5	Tf	828	10.0	Ht	890	15.9	Wn	011272			865	8.8	Ah	889	10.2	BL
869	6.5	Kd	829	9.9	Sm	**— Cas**			883	13.6	Br	880	8.7	Ah	891	10.0	BL
882	6.3	Kd	838	8.9	Bl	004746b			**U Psc**			882	8.8	Ah	892	9.6	Lg
883	6.1	L	848	8.7	Bl	858	10.7	Wn	011712			883	8.7	Ah	893	9.4	BL
885	6.5	Tf	848	9.0	Ht	887	10.8	Pt	864	12.3	L	887	8.7	Pt	896	9.5	BL
T And			851	9.1	Dr	890	11.1	Wn	885	11.6	L	889	8.8	BL	899	9.6	BL
001726			854	9.3	En	**W Cas**			887	11.6	Pt	891	8.8	BL	903	9.7	BL
861	9.6	Ch	859	8.8	Bl	004958			888	11.5	Wn	892	8.7	Lg	**R Cet**		
877	11.5	Jo	865	9.3	Dr	875	10.0	BL	**R Scl**			893	8.9	BL	*022000*		
879	12.0	Jo	869	9.0	Bl	877	8.7	Jo	*012233a*			896	8.7	BL	857	7.8	L
882	11.4	Dr	878	10.2	Bl	879	10.0	BL	851	6.9	Dr	899	8.7	BL	866	7.9	Ch
887	12.0	Pt	**W Scl**			883	9.7	BL	865	6.7	Dr	903	8.7	BL	884	9.1	L
895	12.3	Lg	*002833*			887	9.2	Pt	882	8.2	Kd	**Z Cep**			888	9.6	Wn
T Cas			838	13.1	Bl	889	9.2	Jo	**RS Scl**			021281			889	10.0	Jo
001755			851	13.0	Bl	889	9.8	BL	*012233b*			866	13.8	L	893	10.4	Jo
860	8.3	L	851	12.7	Dr	891	9.7	BL	866	12.7	Dr	883	13.8	Br	**RR Per**		
866	7.8	L	865	13.3	Dr	892	9.7	Lg	**RZ Per**			885	14.4	L	022150		
877	7.5	Jo				893	9.3	Jo	012350						859	9.3	L
879	7.6	Ch				893	9.3	BL	864	12.6	L				866	9.6	L

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1929.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RR PER	U ARI	T CAM	R ORI	W AUR	RR TAU
022150	030514	043065	045307	052036	063326
883 10.3 Br	871 10.9 L	856 8.1 L	857 11.7 L	888 10.0 Wn	885 12.7 L
887 10.8 Pt	895 12 8 Lg	859 8.6 By	871 10.5 L	895 9.3 Lg	RU AUR
R FOR	X CET	861 8.6 By	883 10.8 L	S ORI	053337
022426	*031401*	863 8.7 By	R LEP	*052404*	869[12.4 Pt
838 11.2 Bl	857 11.6 L	866 8.4 L	*045514*	869 9.6 Pt	SU TAU
851 11.3 Bl	871 11.6 L	873 8.8 By	857 7.0 L	T ORI	054319
859 11.3 Bl	885 11.6 L	880 8.9 By	859 7.5 Tf	*053005a*	856 9.6 L
869 10.5 Bl	887 10.4 Pt	882 9.0 By	867 6.8 Tf	856 10.3 L	857 9.5 L
U CET	Y PER	883 8.7 Br	869 6.1 Pt	857 10.1 L	858 9.5 L
022813	032043	884 8.7 L	871 6.7 L	858 10.0 L	859 9 5 L
887 12.4 Pt	883 10.2 BL	887 8.6 Pt	879 6.8 Jo	859 10.2 L	860 9.6 L
RR CEP	887 9.6 Pt	RX TAU	884 6.8 L	860 10.2 L	861 9.5 L
022980	889 10.1 BL	043208	885 6.6 Tf	861 10 1 L	862 9.5 L
859[14.0 L	892 10.2 Gb	857 10.5 L	889 6.5 Jo	862 10.2 L	864 9.5 L
866[13.7 L	892 10.0 Lg	871 9.7 L	893 6.4 Jo	864 10.2 L	865 9.5 L
885[13.7 L	893 10.2 BL	883 9.3 L	V ORI	865 10.2 L	866 9.6 L
R TRI	896 10.0 BL	887 9.5 Pt	050003	866 10.2 L	867 9.6 L
023133	899 10.0 BL	888 9.4 Wn	862 13.9 L	867 10.0 L	868 9.6 Pt
857 11.4 Ah	903 10.0 BL	R RET	871 14.1 L	868 10.5 Pt	869 9.6 Pt
859 11.4 Ah	R PER	*043263*	884 14.1 L	869 10.5 Pt	869 9.5 L
863 11.3 Ah	032335	828 7.8 Ht	T LEP	869 10.3 L	870 9.6 L
865 11.4 Ah	866 12.0 L	838 8.0 Bl	*050022*	870 10.2 L	870 9.6 Pt
866 11.4 Ah	883 12.8 Br	848 8.8 Bl	869 12.0 Pt	870 10.4 Pt	871 9.6 Pt
866 11.6 Ch	886 12 8 Sd	851 8.5 Dr	S PIC	871 10.5 Pt	871 9.6 L
877 11.5 Jo	T FOR	859 9.5 Bl	*050848*	871 10.2 L	875 9.6 L
879 11.7 Jo	*032528*	865 9.2 Dr	838[12.9 Bl	876 10.7 L	876 9 6 L
880 11.5 Ah	860 8.9 L	869 9.6 Bl	851 13.2 Bl	883 10.8 L	883 9.5 L
882 11.5 Ah	870 8.7 L	878 10.4 Bl	851 13.0 Dr	883 11.0 Pt	883 9.6 Pt
883 11.5 Ah	883 8.6 L	X CAM	865 12.1 Dr	884 11.5 L	884 9.4 L
887 12.0 Jo	U ERI	043274	R AUR	885 11.7 Pt	885 9.5 L
887 11.1 Pt	*034625*	856 9.4 L	050953	888 11.4 Pt	885 9.7 Pt
888 11.5 Wn	851 10.4 Dr	866 10.9 L	869 12.4 Pt	889 11.6 Pt	888 9.6 Pt
W PER	865 10.7 Dr	883 12.4 Br	T PIC	890 11.5 Pt	889 9.7 Pt
024356	884 11.7 L	885 12.7 L	*051247*	893 10.5 Lg	890 9.6 Pt
887 8.8 Pt	T ERI	887 12.3 Pt	838 7.9 Bl	895 10.7 Sp	895 9.7 Sp
889 9.0 Jo	*035124*	R DOR	851 8.3 Bl	S CAM	S COL
893 8.9 Jo	851 11.5 Dr	*043562*	851 8.2 Dr	053068	*054331*
R HOR	865 10.8 Dr	828 5.5 Ht	859 8.7 Bl	869 10.0 Pt	851 11.8 Dr
025050	W ERI	838 5.5 Bl	865 8.9 Dr	RR TAU	865 10.6 Dr
828 11.5 Ht	*040725*	848 5.5 Bl	NOV TAU	053326	Z TAU
838 11.4 Bl	851[12.9 Dr	851 5.1 Dr	051316	857 11.9 L	054615a
848 11.9 Bl	865 12.9 Dr	859 5.5 Bl	862 13.8 L	858 11.5 L	864 13.6 L
851 12.0 Dr	R TAU	869 5.4 Bl	T COL	859 11.5 L	RU TAU
859 12.4 Bl	042209	878 5.4 Bl	*051533*	860 11.0 L	054615c
865 12.1 Dr	887 9.4 Pt	R CAE	838 10.2 Bl	861 11.3 L	861 11.7 L
T HOR	W TAU	*043738*	851 9.2 Dr	862 11.3 L	870 11.9 L
025751	042215	838 8.0 Bl	865 8 3 Dr	864 11.3 L	884 11.9 L
828 11.2 Ht	877 10.6 Jo	851 7.8 Bl	S AUR	865 11.3 L	R COL
838 10.6 Bl	879 10.2 Jo	851 8.0 Dr	052034	866 11.5 L	*054629*
848 9.7 Bl	887 9.7 Pt	865 8.2 Dr	869 8.1 Pt	867 11.3 L	851[13.2 Dr
851 9.8 Dr	893 9.9 Jo	R PIC	895 8.2 Lg	868 11.5 L	865 13.3 Dr
859 9.4 Bl	895 10.1 Lg	*044349*	895 9.1 Sp	869 11.5 L	α ORI
865 8.8 Dr	T CAM	838 7.9 Bl	W AUR	870 11.7 L	054907
869 8.4 Bl	043065	851 8.5 Bl	052036	871 11.6 L	862 0.5 L
878 7.8 Bl	836 8.1 By	851 8.6 Dr	856 11.0 L	875 11.7 L	871 0.7 L
U ARI	842 8.2 By	859 8.6 Bl	866 9.9 L	875 11.6 L	883 0.7 L
030514	850 8.4 By	865 8.9 Dr	869 9.5 Pt	883 12.9 L	
857 10.0 L	854 8.4 By		876 9.4 L	884 13.1 L	

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
U ORI	S LYN	R VOL	U CNC	Y DRA	V HYA
054920a	063558	*070772*	083019	093178	*104620*
869 9.0 Pt	864 13 8 L	828[11.8 Sm	865[12.4 L	865 13.4 L	837 6.0 Bl
877 8.5 Jo	869 14.7 Pt	849 12.0 Dr	884[13.9 L	884 12.3 L	846 7.3 Bl
883 8.8 Ah	883 13.5 L	865 10.9 Dr	S HYA	R LMI	847 7.6 Bl
889 8.2 Jo	X GEM	L_2 PUP	084803	093934	RS CAR
893 8.5 Jo	064030	*071044*	885 12.6 Pt	885 10.1 Pt	*110361*
Z AUR	895 11.4 Sp	851 4.0 Dr	T HYA	R LEO	828[12.3 Sm
055353	W MON	865 4.4 Dr	*085008*	094211	RY CAR
868 11.6 Pt	*064707*	RR MON	883 9.9 L	885 6 6 Pt	*111561*
869 11.6 Pt	869 9.3 Pt	071201	885 11.0 Pt	Z VEL	826[13.1 Ht
870 11.6 Pt	Y MON	883[14.7 L	T CNC	*004053*	846[13.5 Bl
871 11.6 Pt	065111	V GEM	085120	826 11.9 Ht	848[12.7 Ht
883 10.8 Pt	856 10.3 L	071713	885 9.1 Pt	828 12.1 Sm	861[13.3 Dr
885 11.2 Pt	869 10.1 Pt	864 8.7 L	V UMA	831 11.6 Ht	RS CEN
887 11.0 Pt	871 9.4 L	875 8.5 L	090151	837 10.4 Bl	*111661*
888 10.9 Pt	884 9.5 L	885 8.3 Pt	865 9.9 L	846 9.9 Bl	826 9.5 Ht
890 10.6 Pt	X MON	S CMI	883 10.0 L	847 9.4 Dr	828 9.5 Sm
R OCT	*065208*	072708	W CNC	858 8.9 Bl	831 9.2 Ht
055686	859 8.2 L	859 8.9 Tf	090425	861 8.8 Dr	837 8.5 Bl
826 10.1 Ht	871 8.9 L	867 8.3 Tf	865 10.8 L	868 8.8 Bl	846 8.5 Bl
829 10.3 Sm	884 9.2 L	885 7.7 Tf	883 11.5 L	877 8.7 Bl	847 8.4 Dr
831 10.2 Ht	R LYN	885 7.6 Pt	RX UMA	V LEO	848 8.6 Ht
837 10.2 Bl	065355	T CMI	090567	095421	849 8.4 Dr
846 10.6 Bl	857 8.3 Ah	072811	865 10.7 L	885 13.6 Pt	858 8.5 Bl
848 10.4 Ht	858 8.4 Ah	864 10.8 L	883 11.0 L	RV CAR	861 8.5 Dr
849 10.8 Dr	859 8.4 Ah	875 10.6 L	RW CAR	*095563*	867 8.6 Dr
853 11.0 En	862 7.3 L	S VOL	*091868*	851[13.1 Bl	868 8.5 Bl
859 10.7 Bl	863 8 5 Ah	*073173*	826 9.4 Ht	S CAR	876 9.0 Dr
867 11.1 Dr	865 8.6 Ah	837 13.0 Bl	831 9.5 Ht	*100661*	877 9.1 Bl
869 10.7 Bl	866 8.5 Ah	846[13.2 Bl	837 9.6 Bl	826 5.8 Ht	X CEN
878 11.0 Bl	867 8.6 Ah	849 13.0 Dr	846 9.6 Bl	828 6.0 Sm	*111441*
X AUR	869 7.9 L	865 13.6 Dr	846 9.4 Ht	831 6.0 Ht	849 13.1 Dr
060450	870 8.7 Ah	V CMI	847 9.6 Dr	837 5.5 Bl	861 12.8 Dr
856 10.3 Lj	871 8.5 Ah	073508	858 9.5 Bl	846 6.0 Bl	AD CEN
862 10.0 Lj	872 8.3 Ah	860 9.8 L	865 9.6 Dr	846 6.0 Ht	*114858*
864 9.9 Lj	873 8.4 Ah	875 9.7 L	868 10.2 Bl	847 6.2 Dr	826 9.7 Ht
866 9.8 Lj	880 8.7 Ah	885 9.3 Pt	877 10.2 Bl	849 6.4 Dr	828 9.5 Sm
869 9.3 Pt	882 8.8 Ah	W PUP	Y VEL	858 6.4 Bl	831 9.4 Ht
870 9.8 Lj	883 8.8 Ah	*074241*	*002551*	861 6.7 Dr	832 9.3 En
879 9.6 Lj	883 8.3 L	851 11.9 Dr	827 11.3 Ht	867 7.5 Dr	848 9.1 Ht
881 9.4 Lj	V CMI	865 13.0 Dr	828 10.4 Sm	868 7.0 Bl	W CEN
883 9.4 Lj	070109	U PUP	831 11.3 Ht	876 7.9 Dr	*115058*
V AUR	864 8.0 L	*075612*	837 11.4 Bl	877 7.6 Bl	826 9.8 Ht
061647	875 8.2 L	883 11.6 L	846 11.8 Bl	Z CAR	828 9.9 Sm
858 10.0 L	R GEM	R CNC	R CAR	*101058a*	831 9.5 Ht
866 9.4 L	070122a	081112	*092062*	831[12.6 Ht	832 9.6 En
883 10.0 L	885 11.0 Pt	885 11.0 Pt	826 9.8 Ht	858[12.3 Bl	837 9.1 Bl
V MON	895 9.3 Sp	V CNC	828 10.0 Sm	W VEL	846 9.0 Bl
061702	Z GEM	081617	831 9.8 Ht	*101153*	847 8.5 Dr
869 6.2 Pt	070122b	856 9.0 L	837 9.8 Bl	828 12.0 Sm	848 8.6 Ht
AG AUR	885 12.6 Pt	876 10.5 L	846 9.6 Bl	831 12.3 Ht	848 8.4 En
062047	TW GEM	885 11.8 Pt	847 9.5 Dr	837 12.2 Bl	858 8.9 Bl
858 9.3 L	070122c	RT HYA	848 9.6 Ht	846 12 6 Bl	861 8.3 Dr
866 9.0 L	885 7.9 Pt	*082405*	849 9.5 Dr	849 12.5 Dr	867 8.3 Dr
876 9.0 L	R CMI	885 8.2 Pt	858 9.0 Bl	R UMA	868 8.4 Bl
R MON	070310	R CHA	861 9.5 Dr	103769	876 8.0 Dr
063308	864 8.0 L	*082476*	865 9.1 Dr	856 12.8 Pt	877 8.8 Bl
869 11.8 Pt	875 8.1 L	828[12.4 Sm	868 9.1 Bl	885 13.0 Pt	
		851[13.0 Bl	877 8.8 Bl		

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1929.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
U CEN			S UMA			R HYA			RX CEN			U UMI			S LEP		
122854			123961			*132422*			*134536*			141567			*144646a*		
832	8.4	En	859	8.2	Lj	847	7.9	Bl	832[	12.1	En	870	9.1	Ah	850[	12.1	En
837	8.2	Bl	861	8.2	Kl	848	8.5	En	850[	12.1	En	871	9.1	Ah	Y LUP		
846	7.8	Bl	862	8.2	Lj	852	7.9	Ch	851[	13.1	Bl	872	9.1	Ah	*145251*		
847	7.6	Dr	863	7.7	Ah	858	7.8	Bl	T APS			873	9.2	Ah	828[	12.8	Sm
848	7.9	En	864	8.3	Kl	868	7.5	Bl	*134677*			877	8.8	Jo	851	12.1	Bl
858	8.4	Bl	864	8.2	Lj	877	7.6	Bl	826[	12.7	Ht	878	9.5	Ah	858	11.2	Bl
861	7.8	Dr	865	7.7	Ah	S VIR			829[	12.7	Sm	878	9.0	Pt	861	10.8	Dw
867	8.1	Dr	866	7.7	Ah	*132706*			850[	12.7	En	879	9.2	Lj	861	10.8	Dr
868	8.4	Bl	867	7.7	Ah	826	8.6	Ht	851[	13.2	Bl	880	9.3	Lj	867	10.3	Dr
876	8.3	Dr	867	8.1	Lj	828	8.1	Sm	Z BOO			880	9.5	Ah	868	10.0	Bl
877	8.4	Bl	868	8.3	Kl	831	8.6	Ht	140113			881	9.4	Ah	876	9.6	Dr
T UMA			870	8.0	Ah	832	8.5	En	859	10.8	L	882	9.5	Ah	877	9.7	Bl
123160			870	8.2	Lj	846	9.3	Ht	883	9.2	L	883	9.6	Ah	S APS		
850	9.0	Kl	871	8.0	Ah	848	9.1	En	RU HYA			883	9.8	Lj	*145071*		
853	9.0	Kl	872	8.1	Ah	852	9.4	Ch	*140528*			884	9.7	Lj	826	11.0	Sm
856	9.0	Kl	873	8.2	Ah	RV CEN			826[	12.9	Ht	884	9.7	Ah	826	11.2	Ht
857	8.6	Ah	874	8.2	Wd	*133155*			828[	12.5	Sm	889	9.3	Jo	828	11.0	Sm
858	8.6	Ah	877	8.4	Jo	832	8.0	En	831	13.2	Ht	893	9.7	Jo	829	11.0	En
858	8.9	Kl	878	8.3	Ah	837	7.5	Bl	846	11.7	Ht	S BOO			831	11.1	Ht
859	8.6	Ah	879	8.5	Lj	847	7.6	Bl	848	11.1	Dr	141954			837	11.3	Bl
861	8.7	Kd	880	8.7	Lj	850	7.6	En	850	10.8	En	854	13.1	Ch	847	11.3	Bl
863	8.6	Ah	880	8.3	Ah	858	7.5	Bl	858	9.6	Bl	859	13.3	L	848	11.1	Ht
864	8.7	Kl	881	8.4	Ah	868	7.5	Bl	861	9.0	Dr	878	12.6	Pt	848	11.1	Dr
865	8.7	Ah	882	8.5	Ah	877	7.6	Bl	868	8.9	Bl	879	13.5	L	850	11.0	En
866	8.7	Ah	882	8.8	Lj	T UMI			876	8.6	Dr	RS VIR			851	11.1	Dr
867	8.6	Ah	883	8.4	Ah	133273			877	8.8	Bl	142205			858	11.4	Bl
868	8.7	Kl	884	8.5	Ah	859	11.0	L	R CEN			857	13.3	L	867	11.1	Dr
870	8.6	Ah	884	9.1	Lj	876	11.9	L	*140959*			867	12.4	L	868	11.1	Bl
871	8.5	Ah	885	8.2	Pt	883	12.3	Br	826	8.1	Ht	883	9.0	L	876	11.0	Dr
872	8.6	Ah	889	8.5	Wd	T CEN			828	8.1	Sm	V BOO			877	11.2	Bl
873	8.6	Ah	889	8.5	Jo	*133633*			829	8.0	En	142539a			T LIB		
874	8.6	Hs	893	8.8	Jo	826	7.2	Ht	831	8.3	Ht	854	10.7	Ch	*150519*		
874	8.5	Wd	899	8.9	Wd	828	6.9	Sm	837	7.8	Bl	866	10.1	Ah	853	12.1	Ch
877	8.5	Jo	U OCT			831	7.0	Ht	847	7.2	Bl	867	10.2	Ah	859	11.0	L
878	8.5	Ah	*131283*			832	7.0	En	847	7.5	Dr	873	10.1	Ah	Y LIB		
880	8.4	Ah	826	8.5	Ht	837	6.8	Bl	848	7.5	Ht	878	10.5	Jo	*150605*		
880	8.4	Hs	829	8.0	Sm	846	6.2	Ht	850	7.5	En	878	10.1	Pt	857	11.0	L
881	8.3	Ah	831	8.2	Ht	847	6.2	Bl	858	7.0	Bl	879	10.5	Ga	867	11.7	L
882	8.4	Ah	832	8.3	En	847	6.6	Dr	867	6.6	Dr	880	10.2	Ah	883	12.2	L
883	8.4	Ah	837	8.2	Bl	849	6.6	Dr	868	6.1	Bl	888	10.1	Ga	S LIB		
884	8.4	Ah	846	8.2	Bl	850	6.6	En	876	6.0	Dr	889	9.7	Jo	*151520*		
885	8.5	Pt	848	8.5	Ht	858	6.0	Bl	877	6.0	Bl	893	9.5	Jo	853	8.5	Ch
889	8.2	Jo	848	9.0	En	868	6.0	Bl	U UMI			R CAM			859	8.9	L
889	8.5	Wd	849	8.4	Dr	876	6.3	Dr	141567			142584			S SER		
893	8.5	Jo	858	8.6	Bl	877	6.8	Bl	856	8.8	Ah	883	10.2	Br	151714		
RS UMA			861	8.4	Dr	RT CEN			856	8.8	Lj	R BOO			853	10.4	Ch
123459			867	8.4	Dr	*134236*			857	8.8	Ah	143227			857	10.1	L
885	13.4	Pt	868	8.4	Bl	826	12.0	Ht	858	8.8	Ah	854	12.7	Ch	867	8.9	L
S UMA			876	8.9	Dr	828	13.0	Sm	859	8.8	Ah	857	12.6	Lj	876	9.2	L
123961			877	8.7	Bl	831	12.0	Ht	859	8.9	Lj	861	12.6	Lj	878	9.2	Pt
850	7.6	Kl	R HYA			837	13.3	Bl	861	8.8	Lj	862	12.6	Lj	880	9.7	Hs
853	7.7	Kl	*132422*			846	12.7	Ht	863	8.9	Ah	878	12.3	Pt	883	9.1	L
856	7.9	Kl	826	8.5	Ht	847	13.4	Bl	864	8.8	Lj	879	12.3	Lj	888	9.6	Hs
856	8.0	Lj	828	7.8	Sm	848	13.4	Dr	865	9.0	Ah	880	12.3	Lj	S CRB		
857	7.6	Ah	831	8.4	Ht	858	13.3	Bl	866	9.1	Ah	882	12.3	Lj	151731		
858	7.7	Ah	832	8.5	En	861	12.9	Dr	867	9.1	Ah	V LIB			853	12.4	Ch
858	8.1	Kl	837	7.9	Bl				867	9.0	Lj	*143117*			878	10.3	Pt
859	7.5	Ah	846	8.0	Ht				870	9.1	Lj	859[	12.7	L	878	11.0	Jo

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs
S CrB	S UMi	R CrB	R CrB	Z Sco	W CrB
151731	153378	154428	154428	*160021*	161138
880 10.5 Ah	870 8.1 Ah	862 6.1 Ch	890 5.9 Jo	848 10.3 Ht	878 11.0 Pt
888 9.2 Ga	871 8.4 Ah	863 6.2 Lj	890 6.1 Pt	850 10.1 En	878 11.1 Sp
889 10.5 Jo	872 8.4 Ah	864 6.2 Lj	891 6.1 Gy	857 10.0 L	879 9.8 Jo
RS Lib	873 8.5 Ah	864 6.3 Kl	892 6.1 Pt	858 9.9 Bl	889 9.9 Jo
151822	877 8.2 Jo	865 6.2 Lj	893 6.1 Pt	867 9.9 L	893 10.0 Jo
826 7.9 Ht	878 8.2 Pt	865 6.0 Sp	893 5.9 Jo	868 9.7 Bl	W Oph
829 7.6 Sm	878 8.2 Ah	866 6.2 Lj	894 6.2 Hs	877 9.6 Bl	*161607*
831 8.0 Ht	879 8.6 Lj	866 6.2 Ah	895 5.9 Hs	883 9.7 L	859 12.5 L
838 7.7 Bl	880 8.2 Ah	867 6.3 Ah	X CrB	X Sco	879 13.5 L
847 8.1 Bl	881 8.2 Ah	867 6.1 Tf	154536	*160021a*	V Oph
848 8.9 Ht	882 8.2 Ah	867 6.0 L	853 8.8 Ch	851 13 0 Bl	*162112*
850 8.9 En	883 8.2 Ah	867 6.2 Lj	859 9.0 L	858 12.8 Bl	853 10.3 Ch
858 9.1 Bl	883 8.3 Sf	869 6.1 Pt	876 9.8 L	SX Her	859 9.9 L
859 9.6 L	883 8.6 Lj	870 6.2 Lj	878 9.5 Pt	160325	867 9.8 L
868 9.7 Bl	884 8 3 Ah	870 6.1 Pt	879 9.3 Mg	857 8.4 L	878 9.0 Pt
877 10.0 Bl	885 8.5 Lj	871 6.1 Ah	R Ser	869 8.5 Pt	879 10.1 L
RU Lib	889 8.5 Jo	871 6.2 Lj	154615	870 8.4 Pt	U Her
152714	891 8.3 Gy	871 6.1 Kd	853[13.4 Ch	872 8.5 Pt	162119
859 13.0 L	893 8.8 Jo	872 6.1 Ah	878 11.5 Pt	873 8.3 Pt	850 9.7 Kl
R Nor	894 8.4 Gy	872 6.0 Sp	V CrB	874 8.1 L	853 9.7 Kl
152849	U Lib	872 6.2 Pt	154639	875 8.3 Pt	853 10.0 Ch
826 10.1 Ht	*153620a*	873 5.9 Kd	875 7.4 BL	878 8.1 Pt	856 9.7 Kl
829 10.1 Sm	851[12.9 Bl	873 6.2 Pt	878 7.0 Pt	883 8.3 Pt	858 9.8 Kl
831 9.9 Ht	T Nor	874 5.6 Hs	879 7.3 BL	885 8.0 Pt	858 9.9 Ah
837 8.8 Bl	*153654*	874 6.2 Wd	883 7 3 BL	885 7.8 L	861 9.8 Kl
847 8.5 Bl	831[13.1 Ht	874 6.0 L	885 7.5 Md	886 7.9 Pt	864 9.5 Kl
848 8.9 Ht	848 12.8 Ht	875 6.0 Pt	888 7.5 BL	887 8.0 Pt	866 9.8 Ah
848 8.6 Dr	848 12.9 Dr	876 6.2 Kd	889 7.6 BL	890 8.1 Pt	867 9.8 Ah
850 8.8 En	850 12.8 En	876 6.0 L	891 7.6 BL	892 8 0 Pt	871 9.8 Ah
858 7.9 Bl	876 8.8 Dr	877 5.8 Jo	896 7.6 BL	893 8.0 Pt	872 9.8 Ah
867 7.3 Dr	Z Lib	878 6.0 Wd	898 7.7 Md	W Sco	873 9.8 Ah
868 7.3 Bl	*153020*	878 6.2 Pt	903 7.5 BL	*160519*	874 10.0 Hs
876 7.2 Dr	851[12.7 Bl	878 6.1 Ah	R Lib	851[12.5 Bl	877 9.5 Jo
877 6.5 Bl	867[12.2 Dr	879 6.1 Ah	*154715*	RU Her	878 9.3 Pt
X Lib	R CrB	879 6.0 L	859 13.5 L	160625a	878 9.8 Ah
153020	154428	879 6.2 Lj	R Lup	853 12.8 Ch	879 9.7 Ah
838 11.3 Bl	830 6.1 Kd	880 6.0 Ah	*154736*	857 13.5 L	879 9.5 Ga
847 11.9 Bl	845 6.1 Kd	880 5.8 Hs	848 13.5 Dr	878 12.7 Pt	880 9.7 Ah
858 12.4 Bl	850 6.2 Kd	880 6.2 Lj	RR Lib	879 13.6 L	880 9.4 Hs
W Lib	850 6.5 Kl	881 6.2 Lj	*155018*	R Sco	882 9.5 Ah
153215	853 6.1 Ch	882 6.2 Lj	848 13.2 Dr	*161122a*	883 9.5 Ah
851[13.0 Bl	856 6.1 L	882 6.0 Ah	859 13.4 L	829[12.6 Sm	883 9.3 Sf
853[13.0 Ch	856 6.2 Lj	883 6.0 Ah	876[13.2 L	831[12.6 Ht	888 8.9 Hs
S UMi	857 6.2 Lj	883 6.2 Lj	RZ Sco	847 12.3 Bl	889 9.1 Sf
153378	857 6.3 Tf	883 6.1 Pt	*155823*	848[12.6 Ht	889 8.5 Jo
853 8.6 Ch	857 5.9 L	883 6.1 L	826 8.9 Ht	858 11.9 Bl	890 8.4 Hs
856 8.7 Lj	857 6.2 Kd	884 6.2 Lj	829 8.4 Sm	868 11.1 Bl	893 7.9 Jo
857 8.4 Ah	858 6.1 Sp	885 6.2 Lj	831 8.6 Ht	877 10.7 Bl	895 8.1 Hs
858 8.3 Ah	858 6.2 Lj	885 6.0 Tf	848 9.2 Ht	878 10.9 Pt	Y Sco
859 8.3 Ah	858 6.1 Kl	885 6.0 L	850 9.1 En	S Sco	*162319*
861 8.6 Lj	858 6.2 Ah	885 6.1 Mg	878 10.8 Pt	*161122b*	859[13.5 L
863 8.3 Ah	859 6.2 Lj	885 6.1 Pt	Z Sco	828 11.7 Ht	SS Her
864 8.6 Lj	859 6.3 Tf	886 6.1 Pt	*160021*	829 11 9 Sm	162807
865 8.3 Ah	859 6.0 L	887 6.1 Pt	826 10.5 Ht	831 11.9 Ht	859 12.0 L
866 8.3 Ah	861 6.1 L	888 5.9 Hs	829 10.3 Sm	838 12.4 Bl	876 10.0 L
867 8.5 Ah	861 6.1 Tf	888 6.5 Ga	831 10.3 Ht	847 13.0 Bl	878 10.4 Pt
867 8 6 Lj	861 6.2 Lj	889 6.2 Wd	838 10.1 Bl	850[12.2 En	
870 8.6 Lj	862 6.2 Lj	889 6.0 Gb	847 10.1 Bl	858 13.2 Bl	

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T OPH	RR OPH	RT SCO	S OCT	RY HER	W DRA
162815	*164319*	*165636*	*172486*	175519	180565
843 14.0 Wn	859 11.4 L	838 8.2 Bl	831[13.0 Ht	859 13.5 L	893 9.9 Lg
847[13.1 Bl	867 11.2 L	847 8.8 Bl	838[13.0 Bl	878 12.6 Pt	908 11.7 Md
859[13.8 L	879 10.9 L	848 8.6 Dr	848[13.0 Ht	879 13.3 L	X DRA
S OPH	S HER	852 9.4 En	851 13.5 Bl	907 11.5 Md	180666
162816	164715	859 8.9 Bl	857 14.2 Dr	V DRA	859 14.0 L
851 12.8 Bl	858 8.0 Ah	868 9.7 Bl	857 14.0 Dw	175654	867 12.9 L
858 12.1 Bl	860 7.4 Ch	876 9.8 Dr	RU OPH	859 12.2 L	876 12.0 L
859 11.9 L	866 7.8 Ah	877 10.4 Bl	172809	876 13.1 L	893 10.9 Lg
867 11.5 L	867 7.9 Ah	— DRA	859 9.6 L	878 12.8 Pt	908 11.1 Md
868 11.1 Bl	871 7.9 Ah	165752	860 9.5 Ch	893[14.0 Lg	NOV OPH
877 10.4 Bl	872 8.0 Ah	876 9.6 L	867 9.2 L	908[12.4 Md	180911
879 10.1 L	873 7.9 Ah	R OPH	876 9.6 L	R PAV	878[13.0 Pt
W HER	878 8.0 Ah	*170215*	878 9.2 Pt	*180363*	TV HER
163137	878 7.5 Pt	853 8.6 Ch	RT SER	828[11.9 Sm	181031
853 12.8 Ch	879 8.1 Ah	856 8.4 Bc	*173411*	831[12.3 Ht	861 13.9 L
878 14.4 Pt	880 8.1 Ah	859 8.9 L	859 12.6 L	853 11.8 En	879 14.0 L
R DRA	882 8.0 Ah	867 9.0 L	879 12.6 L	857 11.5 Dw	W LYR
163266	883 8.2 Ah	877 9.8 Jo	RU SCO	858 11.7 Dr	181136
856 8.3 Lj	RS SCO	878 9.6 Pt	*173543*	876 10.7 Dr	861 11.7 L
857 8.7 Ah	*164844*	879 9.9 L	838 9.3 Bl	T HER	868 12.5 Bc
858 8.7 Ah	828 6.9 Ht	879 9.4 Ch	847 8.8 Bl	180531	869 11.8 L
859 8.6 Ah	829 7.2 Sm	889 10.1 Jo	848 9.1 Dr	858 8.2 Bc	878 12.1 Pt
860 8.6 Ch	831 6.6 Ht	RT HER	852 9.5 En	858 8.5 Ah	879 11.9 L
861 8.8 Lj	838 6.2 Bl	170627	859 8.8 Bl	859 8.5 Ah	RV SGR
863 8.7 Ah	838 6.4 Bl	853[12.9 Ch	868 8.6 Bl	859 8.2 L	*182133*
864 8.9 Lj	848 6.5 Ht	859[13.8 L	876 8.6 Dr	861 8.7 Tf	838 8.4 Bl
865 8.7 Ah	848 6.4 Dr	893[12.0 Lg	877 8.6 Bl	863 8.6 Ah	847 9.0 Bl
866 8.8 Ah	852 7.0 En	RW SCO	SV SCO	865 8.6 Ah	848 8.7 Dr
867 8.8 Ah	858 7.1 Bl	*170833*	*174135*	866 8.5 Ah	859 10.1 Bl
867 9.2 Lj	868 7.1 Bl	838 9.7 Bl	838[12.5 Bl	867 8.6 Ah	868 10.3 Bl
870 9.2 Lj	876 7.2 Dr	847 10.1 Bl	851[13.0 Bl	867 8.4 L	876 10.4 Dr
870 8.9 Ah	877 7.2 Bl	848 9.8 Dr	861 14.8 Dr	870 8.8 Ah	877 10.8 Bl
871 9.0 Ah	RR SCO	852 10.8 En	861 14.9 Dw	871 8.8 Ah	SV HER
872 9.0 Ah	*165030a*	859 9.9 Bl	W PAV	872 8.9 Ah	182224
873 9.1 Ah	828 8.8 Ht	868 10.3 Bl	*174162*	873 9.0 Ah	861 11.2 L
874 9.0 Wd	829 9.0 Sm	876 10.0 Dr	831[13.0 Ht	874 8.9 Hs	878 12.0 Pt
874 9.2 Hs	831 8.8 Ht	877 10.2 Bl	851[13.5 Bl	876 8.8 Ch	879 12.8 L
877 9.0 Jo	838 8.3 Bl	Z OPH	857 14.5 Dr	876 9.0 L	879 12.6 Ch
878 9.3 Pt	847 7.9 Bl	171401	857 13.9 Dw	878 9.2 Ah	T SER
878 9.3 Ah	848 7.9 Ht	856 7.8 Be	RS OPH	878 9.5 Pt	182306
879 9.7 Lj	848 7.7 Dr	866 8.0 Ah	174406	879 9.0 Jo	852 9.6 Wn
880 9.9 Lj	852 7.4 En	867 8.0 Ah	878 11.1 Pt	880 9.6 Ah	878 10.5 Pt
880 9.3 Hs	858 6.9 Bl	871 8.0 Ah	U ARA	880 9.5 Hs	SV DRA
880 9.3 Ah	868 5.9 Bl	872 8.0 Ah	*174551*	882 9.7 Ah	183149
881 9.4 Ah	876 6.0 Dr	877 8.3 Sp	825[13.0 Ht	883 9.8 Ah	861 12.1 L
882 9.5 Ah	877 5.8 Bl	878 7.6 Pt	848 11.4 Ht	884 9.8 Ah	881 12.8 L
883 9.5 Ah	RV HER	878 8.2 Ah	848 11.0 Dr	885 9.2 Tf	893[13.9 Lg
883 9.8 Lj	165631	879 8.0 Ah	853 10.2 En	887 9.7 Jo	RZ HER
888 10.2 Hs	853 10.3 Ch	880 8.2 Ah	876 8.3 Dr	888 9.7 Hs	183225
888 9.6 Ah	859 9.9 L	882 8.1 Ah	RT OPH	889 11.0 Gb	861 13.3 L
889 9.7 Jo	867 10.4 L	883 8.1 Ah	175111	890 8.4 Hs	881 13.9 L
889 10.0 Wd	878 11.3 Pt	RS HER	879[12.5 Ch	893 11.4 Jo	893[13.5 Lg
890 10.4 Hs	879 10.2 L	171723	T DRA	W DRA	X OPH
893 10.0 Jo	879 11.6 Mg	852 8.2 Wn	175458a	180565	183308
895 10.5 Hs	884 9.8 Md	878 9.8 Pt	879 12.0 Ch	859 9.4 L	861 6.7 L
RR OPH	906 12.7 Md	892 10.0 Lg	UY DRA	867 9.3 L	876 6.8 L
164319		906[12.5 Md	175458b	876 10.0 L	876 7.2 Ga
829[11.7 Sm			879 10.8 Ch	878 10.2 Pt	

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J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.
X OPH		R SCT		R SCT		R AQL		W AQL		RY SGR	
183308		*184205*		*184205*		190108		*191007*		*191033*	
877	6.8 Jo	870	6.4 L	893	5.2 Pt	880	11.7 Ah	852	8.7 Wn	887	6.4 Pt
878	7.0 Pt	870	6.4 Kd	893	5.5 Jo	882	11.6 Ah	885	9.7 Pt	890	6.5 Pt
889	7.2 Jo	871	6.0 Kd	894	5.3 Lg	V LYR		887	9.8 Sd	892	6.6 Pt
893	7.3 Jo	871	6.5 Lj	894	5.3 Wd	190529a		T SGR		TY SGR	
RS DRA		872	6.0 Bc	895	5.3 Lg	852	10.8 Wn	*191017*		*191124*	
184074		872	6.3 Pt	899	5.4 Wd	856	11.2 Md	845	11.4 Ch	837	[13.0 Bl
829	10.5 By	872	5.9 Sp	Nov AQL		862	12.2 L	861	10.4 L	849	14.0 Dr
842	10.4 By	873	5.7 Kd	184300		877	12.6 L	876	9.9 L	849	13.8 Dw
850	10.4 By	873	6.1 Pt	856	10.6 Ch	RX SGR		877	10.0 Ch	851	[13.0 Bl
854	10.4 By	874	6.1 Bc	869	11.7 Pt	*190818*		885	9.7 Pt	861	14.6 Dr
858	10.5 By	874	6.6 Wd	875	11.7 Pt	853	11.0 En	R SGR		861	14.4 Dw
863	10.4 By	875	5.9 Bc	878	11.7 Pt	861	11.8 L	*191019*		S SGR	
873	10.4 By	875	6.1 Pt	878	11.0 Sp	883	12.2 L	845	10.2 Ch	*191319a*	
880	10.4 By	876	5.9 Bc	880	10.7 Mg	894	10.9 Lg	855	9.9 En	851	13.7 Bl
882	10.4 By	876	5.6 L	886	11.6 Pt	RW SGR		861	9.6 L	859	[13.5 Bl
RY LYR		876	5.7 Ch	RX LYR		*190819a*		876	8.6 L	861	[13.7 L
184134		876	5.5 Kd	185032		853	9.3 En	877	8.0 Ch	877	14.0 Bl
862	12.3 L	877	5.9 Ga	883	[14.5 L	861	9.0 L	877	8.5 Sp	883	[14.4 L
881	13.0 L	877	5.7 Sd	907	[12.5 Md	883	9.4 L	878	8.4 Hs	SW SGR	
R SCT		877	5.7 Sp	S CRA		885	9.6 Pt	883	8.4 Hs	*191331*	
184205		877	6.0 Pt	*185437a*		894	8.7 Lg	885	8.0 Pt	837	12.4 Bl
827	5.6 Kd	877	5.8 Jo	838	12.1 Bl	BH SGR		888	8.1 Hs	847	12.2 Bl
828	6.7 Kd	877	6.0 Bc	847	11.7 Bl	*190816*		RY SGR		848	12.1 Dr
829	5.8 Kd	878	6.0 Bc	853	11.7 En	861	12.2 L	*191033*		859	11.9 Bl
830	5.7 Kd	878	5.9 Pt	859	12.3 Bl	883	12.6 L	825	6.9 Ht	865	11.7 Dr
838	6.6 Kd	878	6.1 Wd	ST SGR		TY AQL		826	6.5 Sm	868	11.7 Bl
845	7.4 Kd	879	5.5 Sd	*185512a*		*190907*		828	6.5 Sm	877	11.5 Bl
850	7.5 Kd	879	5.7 Lj	861	9.5 L	852	10.3 Wn	828	6.9 Ht	TZ CYG	
851	7.4 Kd	879	5.7 Jo	876	10.3 L	885	10.6 Pt	828	6.6 Kd	191350	
852	7.4 Kd	879	5.9 Bc	R CRA		887	10.3 Sd	829	6.5 Kd	885	10.8 Pt
853	7.3 Ch	880	5.7 Lj	*185537a*		S LYR		831	6.9 Ht	U LYR	
854	7.4 Kd	880	5.6 Mg	838	13.0 Bl	190925		837	6.0 Bl	191637	
856	8.0 Bc	881	5.7 Lj	847	12.1 Bl	852	12.2 Wn	847	5.5 Bl	885	12.0 Pt
856	7.9 Lj	881	5.3 Tf	853	12.0 En	862	11.8 L	847	6.2 Dr	T SGE	
857	7.9 Lj	882	5.1 Bc	859	12.4 Bl	877	12.3 L	848	6.3 Dr	191717	
857	8.0 Bc	882	5.7 Lj	T CRA		877	12.3 Ch	848	6.5 Ht	861	9.5 Tf
857	7.5 Kd	883	5.7 Lj	*185537b*		885	12.4 Pt	851	6.3 Ch	AF CYG	
858	7.4 Sp	883	5.5 Pt	838	[13.0 Bl	X LYR		853	6.5 En	192745	
858	7.8 Bc	883	5.1 L	847	13.5 Bl	190926		857	6.2 Kd	857	7.8 Ah
859	7.8 Lj	884	5.6 Lj	Z LYR		885	9.0 Pt	857	6.7 Tf	858	7.9 Ah
859	7.6 Tf	885	5.7 Lj	185634		RS LYR		859	6.3 Bl	859	7.8 Ah
860	7.2 Bc	885	5.5 Pt	862	12.5 L	190933a		859	6.5 Tf	863	7.9 Ah
861	7.8 Lj	885	5.0 Tf	876	12.1 L	862	13.0 L	861	6.5 Tf	865	7.8 Ah
861	7.5 Tf	885	5.6 Sd	878	12.6 Pt	883	13.6 L	861	6.5 L	867	7.9 Ah
861	6.5 L	885	5.0 Bc	893	11.0 Lg	RU LYR		868	6.0 Bl	870	7.8 Ah
862	7.5 Lj	886	5.5 Pt	SU SGR		190941		869	6.5 Pt	872	7.8 Ah
863	7.5 Lj	887	5.6 Jo	*185722*		862	14.0 L	870	6.5 Pt	880	7.9 Ah
864	7.4 Lj	887	5.6 Sd	825	8.8 Ht	883	14.5 L	872	6.4 Pt	881	7.9 Ah
865	7.3 Lj	887	5.4 Pt	831	8.7 Ht	U DRA		875	6.6 Pt	883	8.0 Ah
865	7.2 Bc	888	5.5 Lg	848	8.4 Ht	190967		876	6.5 L	884	8.0 Ah
865	7.1 Sp	889	5.8 Gb	RT LYR		845	12.9 Ch	876	6.5 Dr	TY CYG	
866	7.3 Lj	889	5.8 Wd	185737		852	12.5 Wn	877	6.0 Bl	192928	
867	7.1 Lj	890	5.9 Ga	867	[12.5 Ch	860	12.7 L	878	6.4 Pt	861	12.8 L
867	7.1 Tf	890	5.4 Jo	883	14.3 L	867	12.3 L	883	6.4 Pt	877	13.0 Ch
869	6.6 Pt	890	5.5 Pt	R AQL		877	11.8 L	883	6.5 L	883	13.0 L
869	6.2 Bc	891	4.9 Gy	190108		883	11.8 Br	885	6.6 Pt	893	[13.7 Lg
870	6.7 Lj	892	5.2 Pt	857	11.3 Ah	885	12.2 Pt	885	6.5 Tf		
870	6.5 Pt	892	5.4 Lg	878	11.6 Pt	890	11.6 Wn	886	6.5 Pt		

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J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RT AQL	TU CYG	RU SGR	S CYG	R DEL	U CYG
193311	194348	*195142*	200357	201008	201647
857 10.3 Ah	877 9.5 Ch	828 7.7 Sm	862[13.8 L	877 11.1 Mg	907 7.5 Md
857 10.4 Ch	883 9.3 L	831 6.5 Ht	893[14.5 Lg	877 11.5 L	U MIC
858 10.3 Ah	885 9.3 Pt	838 7.3 Bl	R CAP	883 11.5 Pt	*202240*
859 10.2 Ah	X AQL	848 7.8 Bl	*200514*	RT CAP	838 8.8 Bl
861 10.4 L	194604	848 7.6 Ht	852 12.1 Wn	*201121*	848 9.4 Bl
863 10.2 Ah	861 13.0 L	851 7.5 Dr	861 12.1 L	829 7.2 Kd	851 9.6 Dr
865 10.1 Ah	877 11.8 L	853 8.2 En	877 11.3 L	852 7.1 Kd	859 10.0 Bl
866 10.1 Ah	885 11.2 Pt	859 8.1 Bl	886 11.1 Pt	857 7.3 Kd	865 10.1 Dr
867 10.1 Ah	χ CYG	865 8.4 Dr	S AQL	876 7.2 Kd	868 10.2 Bl
876 9.0 L	194632	868 9.0 Bl	200715a	883 6.3 Pt	877 10.9 Bl
878 9.6 Ah	827 6.1 Kd	877 9.4 Bl	854 10.0 Mg	SX CYG	Z DEL
880 9.3 Ah	828 6.2 Kd	RR AQL	885 11.4 Sd	201130	202817
882 9.2 Ah	830 6.4 Kd	*195202*	886 10.2 Pt	852 14.5 Wn	861 10.1 L
883 9.3 Ah	832 6.3 Kd	861 14.0 L	RW AQL	883[13.9 L	869 9.4 L
885 8.5 Pt	845 6.8 Kd	883 10.8 L	200715b	890 13.5 Wn	883 9.2 Pt
R CYG	850 6.9 Kd	885 11.1 Pt	854 9.2 Mg	891[13.9 Br	884 8.6 L
193449	851 6.6 Ch	RS AQL	885 9.2 Sd	893 13.7 Lg	893 8.7 Lg
857 10.0 Ah	854 7.1 Kd	195308	886 9.3 Pt	RT SGR	ST CYG
858 10.0 Ah	857 7.1 Kd	861 13.1 L	R TEL	*201139*	202954
863 10.0 Ah	857 7.2 Ch	883 13.4 L	*200717*	838 10.0 Bl	860 11.1 L
865 10.2 Ah	857 6.8 Ah	NOV CYG	829 15.0 Dw	848 8.9 Bl	867 11.2 L
874 9.9 Wd	858 6.8 Ah	195553	851[13.5 Bl	848 8.9 Dr	883 11.9 Pt
877 9.8 Ch	858 6.8 Sp	868[12.2 Pt	857 14.7 Dr	859 8.0 Bl	885 12.6 L
879 9.9 Jo	859 7.0 Ah	883[12.2 Pt	857 14.8 Dw	865 7.5 Dr	V VUL
885 10.3 Pt	863 7.1 Ah	RR TEL	RU AQL	868 7.2 Bl	203226
888 10.3 Ga	865 7.1 Ah	*195656*	200812	877 6.3 Bl	883 8.6 Pt
889 10.0 Wd	866 7.2 Ah	825[12.6 Ht	861 14.3 L	WX CYG	R MIC
889 10.7 Jo	867 7.2 Ah	848[12.6 Ht	883 14.0 L	201437b	*203120*
893 11.3 Jo	870 7.2 Ah	Z CYG	W CAP	861 11.9 L	838 8.5 Bl
894 10.4 Wd	871 7.3 Ah	195849	*200822*	867 12.2 L	848 8.4 Bl
899 10.6 Wd	872 7.5 Ah	857 8.5 Ch	851[13.5 Bl	883 10.2 Pt	859 9.4 Bl
RV AQL	873 7.4 Ah	861 8.6 L	Z AQL	885 12.1 L	868 10.3 Bl
193509	874 7.7 Wd	867 9.0 L	*200906*	U CYG	878 11.3 Bl
861 11.8 L	876 7.9 Kd	883 10.2 L	878 9.5 Wa	201647	Y DEL
877 12.8 L	878 7.5 Ah	885 11.4 Pt	887 9.9 Pt	857 7.7 Ah	203611
893[13.4 Lg	880 7.7 Ah	S TEL	RS CYG	858 7.7 Ah	861 12.0 L
T PAV	881 7.9 Ah	*195855*	200938	858 7.8 Md	884 12.6 L
193072	882 7.7 Ah	825 12.8 Ht	851 7.2 Ch	859 7.7 Ah	S DEL
825 11.7 Ht	883 7.9 Ah	831 12.6 Ht	861 7.2 L	863 7.6 Ah	203816
828 11.9 Sm	884 7.5 Ah	838 13.0 Bl	866 7.2 Ch	865 7.8 Ah	856 9.9 Lj
831 11.9 Ht	885 7.9 Pt	848 13.0 Bl	867 7.0 L	867 7.7 Ah	861 9.8 Lj
838 12.5 Bl	885 8.5 Mg	848 12.8 Ht	874 7.3 Hs	870 8.0 Ah	864 9.7 Lj
848 13.0 Bl	S PAV	859 13.0 Bl	879 7.0 Jo	872 7.7 Ah	867 9.4 Lj
848 12.6 Ht	*194650*	SY AQL	883 7.2 Hs	874 7.8 Wd	870 9.6 Lj
848 12.7 Dr	851 7.2 Dr	200212	883 7.2 L	879 7.5 Jo	879 9.6 Lj
853 13.2 En	865 7.5 Dr	852 14.4 Wn	883 7.2 Pt	880 7.8 Ah	881 9.4 Lj
859 13.0 Bl	RR SGR	861 14.6 L	888 7.3 Hs	881 7.8 Ah	883 9.2 Lj
865 13.4 Dr	*194929*	883 14.0 L	889 7.1 Jo	882 7.7 Ah	883 8.5 Pt
RT CYG	838 9.6 Bl	885 13.2 Pt	893 7.1 Jo	883 7.8 Ah	885 8.7 Sd
194048	847 10.3 Bl	891 12.3 Br	893 7.3 Lg	883 7.5 Pt	885 8.9 Lj
877 11.8 Ch	851 10.2 Dr	BU CYG	895 7.3 Hs	884 7.7 Ah	V CYG
885 11.4 Pt	859 10.5 Bl	200250	R DEL	889 7.5 Jo	203847
893 11.3 Jo	865 10.5 Dr	858 11.7 Lj	201008	889 7.8 Wd	860 8.7 L
TU CYG	868 11.0 Bl	861 11.7 Lj	857 10.3 Ah	890 7.6 Md	867 9.0 L
194348	877 11.1 Bl	866 12.0 Lj	861 10.4 L	893 8.0 Sf	883 9.5 Pt
857 11.8 Ch	RU SGR	879 12.7 Lj	863 10.4 Ah	893 7.7 Jo	885 8.8 L
860 11.5 L	*195142*	880 12.8 Lj	865 10.6 Ah	894 8.0 Wd	893 10.2 Sf
867 10.4 L	825 6.9 Ht		876 9.7 Ga	899 7.8 Wd	

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1929.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
Y AQR	S IND	T CEP	S MIC	V PEG	S LAC
203905	*204954*	210868	*212030*	215605	*222439*
852[13.3 Ch	878 11.0 Bl	857 7.6 Ah	865 9.9 Dr	885 13.5 L	885 9.2 Tf
T DEL	X DEL	858 7.6 Ah	868 9.6 Bl	U AQR	893 9.8 Lg
204016	205017	859 7.6 Ah	878 10.3 Bl	*215717*	R IND
852[12.9 Ch	861 12.4 L	863 7.6 Ah	Y CAP	869 12.1 L	*223867*
884 14.3 L	884 13.3 L	865 7.7 Ah	*212814*	876 12.2 Ch	825 10.8 Ht
U DEL	RR CAP	866 7.5 Ah	838 12.7 Bl	883 12.2 Pt	831 11.1 Ht
204017	*205627*	867 7.6 Ah	848 12.9 Bl	885 12.6 L	838 11.7 Bl
859 6.8 Tf	851 11.6 Dr	870 7.6 Ah	859 13.6 Bl	RT PEG	848 12.3 Bl
V AQR	856 12 1 Dr	871 7.6 Ah	885 14.3 L	215934	848 12.4 Ht
204102	T OCT	872 7.5 Ah	W CYG	860 11.7 L	851 12.9 Dr
857 8.9 Md	*205782*	873 7.4 Ah	213244	871 11.1 L	855 13.0 En
861 8.6 L	857 14.4 Dr	874 6.9 Wd	830 6.0 Kd	RZ PEG	859 13.3 Bl
869 8.5 L	857 14.0 Dw	878 7.4 Ah	845 6.1 Kd	220133b	865 13.5 Dr
883 7.8 Pt	R VUL	879 7.5 Ah	850 6.1 Kd	860 12.6 L	T TUC
884 7.8 L	205923a	879 6.9 Jo	857 6.2 Kd	885 11.8 L	*223462*
891 8.0 Md	883 10.0 Pt	880 7.5 Ah	857 5.5 L	T PEG	825 12.8 Ht
907 8.3 Md	V CAP	881 7.4 Ah	859 5.8 Tf	220412	828 12.8 Sm
W AQR	*210124*	882 7.1 Ah	860 5.7 L	861[13.7 L	831 12.6 Ht
204104	838 12.7 Bl	883 7.0 Ah	865 5.7 L	Y PEG	848 10.9 Ht
861 11.6 L	848 13.5 Bl	883 7.1 Pt	867 6.0 Tf	220613	848 10.8 Dr
869 11.8 L	859[13.5 Bl	884 7.1 Ah	870 6.4 Kd	861 10.9 L	855 10.9 En
884 11.8 L	TW CYG	889 6.7 Jo	876 6.3 Kd	888 12.7 Wn	865 9.9 Dr
U CAP	210129	889 6.8 Wd	876 5.8 L	894 13.1 Lg	R LAC
204215	852 10.5 Wn	891 7.5 Gy	884 5.8 L	RS PEG	223841
838[13.5 Bl	860 10.5 L	893 6.6 Jo	885 5.9 Tf	220714	861 13.1 L
851 13.9 Bl	867 10.9 L	RR AQR	S CEP	852 11.3 Wn	867 12.8 L
861[13.9 L	888 11.8 Wn	*210903*	213678	861 12.1 L	876 12.1 Ch
884[13.9 L	X CAP	861 10.1 L	842 10.5 By	888 12.3 Wn	VY AND
V DEL	*210221*	869 9.7 L	850 10.5 By	894 12.3 Lg	225745
204318	851 12.8 Bl	883 10.2 Pt	883 10.5 Pt	R PSA	837 10.5 By
852 14.5 Wn	859 12.4 Bl	885 10.4 L	RU CYG	*221230*	842 10.6 By
888[15.5 Wn	868 12.0 Bl	893 9.8 Lg	213753	851 10.8 Dr	850 10.6 By
891[14.4 Br	878 11.7 Bl	Y PAV	857 9.6 Ah	876 9.2 Dr	852 10.6 By
T AQR	X CEP	*211570*	859 9.8 Ah	T GRU	855 10.5 By
204405	210382	825 6.6 Ht	863 9.7 Ah	*221038*	858 10.5 By
852 10.0 Ch	852 15.2 Wn	831 6.9 Ht	865 9.7 Ah	828 9.6 Sm	870 10.5 By
858 10.9 Sp	881[14.6 Br	848 6.5 Ht	867 9.7 Ah	855 9.6 En	871 10.5 By
877 12.7 Sd	890 16.0 Wn	X PEG	878 9.8 Ah	S GRU	880 10.4 By
879 12.5 Sd	RS AQR	211614	882 9.8 Ah	*221048*	882 10.3 By
879 12.0 Jo	*210504*	872 14 5 L	883 8.9 Pt	825 10 6 Ht	RW PEG
883 12.7 Pt	852 9.8 Wn	878[12.7 Wa	893 8.5 Lg	828 10.0 Sm	*225914*
885 12.5 Sd	861 10.0 L	885 13.7 L	RV CYG	831 10.6 Ht	852 10.4 Ch
887 12.5 Sd	869 10.1 L	894 13.1 Lg	213937	848 11.1 Ht	852 10.6 Wn
RZ CYG	883 10.9 Pt	T CAP	883 6 4 Pt	851 11.3 Dr	858 10.0 Sp
204846	885 10.8 L	*211615*	R GRU	854 11.4 En	861 10.2 L
883 12.9 Pt	Z CAP	838 11.7 Bl	*211247*	865 12.0 Dr	875 9.8 Wa
S IND	*210516*	848 12.4 Bl	828[12.9 Sm	RV PEG	878 9.6 Wa
204954	883 11.7 Pt	852 12.7 Ch	831[12.9 Ht	222129	883 9.1 Pt
825 9.8 Ht	R EQU	859 12.9 Bl	838 13.9 Bl	852 14.2 Wn	885 9.1 L
831 10.0 Ht	210812	885 13.6 L	848[13.7 Bl	876 13.3 Ch	888 9.7 Wn
838 9.5 Bl	852 13.6 Wn	S MIC	848[12.9 Ht	881[13.7 Br	R PEG
848 10.3 Bl	862 13.8 L	*212030*	861 14.8 Dr	888 14.5 Wn	230110
848 10.8 Ht	885 14.4 L	828 10.7 Sm	861 14.6 Dw	S LAC	849 9.0 Kl
851 9.9 Dr	888 14.8 Wn	838 10.2 Bl	V PEG	*222439*	850 9.3 Kl
853 10.6 En	T CEP	848 10.4 Bl	215605	858 9.0 L	852 9.1 Ch
856 10.7 Dr	210868	848 10.2 Dr	861 12.4 L	861 9.0 Tf	856 9.4 Kl
859 10.7 Bl	845 7.6 Ch	854 10.0 En	876 12.6 Ch	867 9.2 L	858 9.3 Kl
868 10.7 Bl	856 7.9 Ch	859 9.7 Bl	881[13.8 Br	883 9.8 Pt	858 9.3 Ah

VARIABLE STAR OBSERVATIONS RECEIVED DURING OCTOBER, 1929.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R PEG	V CAS	S PEG	ST AND	Z CAS	R CAS
230110	230759	231508	233335	233956	235050
859 9.4 Ah	878 10.3 Sf	883 12.1 Pt	881 10.1 Lj	862 14.4 L	854 11.4 Ch
861 9.4 Kl	879 9.9 Ah	885 12.1 L	883 10.1 Lj	881[14.4 Br	888 9.9 Wn
863 9.5 Ah	883 10.4 Sf	893 12.5 Lg	887 10.2 Pt	885 14.1 L	Z PEG
864 9.5 Kl	883 11.0 Pt	V PHE	R AQR	RR CAS	235525
865 9.4 Ah	890 10.4 Wn	*232746*	*233815*	235053	855 10.4 Ch
866 9.5 Ah	892 9.8 Lg	828 12.4 Ht	828 8.7 Ht	881 11.7 Bn	856 10.9 Lj
867 9.6 Ah	W PEG	848 12.4 Ht	838 8.7 Bl	R PHE	861 11.3 Lj
878 9.6 Ah	231425	848 12.2 Dr	848 8.6 Bl	*235150*	862 11.6 L
878 9.6 Sf	836 8.8 Kl	854 12.3 En	848 8.9 Ht	851 13.1 Dr	864 11.4 Lj
880 9.7 Ah	849 9.0 Kl	865 11.3 Dr	852 8.6 Ch	865 13.6 Dr	869 11.8 L
882 9.8 Ah	850 9.0 Kl	Z AND	854 8.9 En	V CET	879 11.8 Lj
883 9.7 Ah	852 8.5 Ch	232848	859 9.1 Tf	*235209*	881 12.0 Lj
883 9.7 Pt	852 9.2 Wn	852 10.4 Wn	859 8.8 Bl	838 13.4 Bl	883 12.2 Lj
889 9.9 Sf	853 8.8 Kl	883 9.7 Pt	862 8.7 L	852 14.0 Wn	885 12.2 L
892 10.0 Gb	856 9.1 Kl	890 10.4 Wn	867 9.0 Tf	R TUC	887 12.3 Pt
V CAS	858 9.0 Kl	894 10.0 Lg	869 8.8 L	*235265*	894 12.6 Lg
230759	858 9.2 L	ST AND	869 8.6 Bl	828[12.9 Sm	Y CAS
852 8.8 Ch	861 9.1 L	233335	877 8.7 Jo	831[13.0 Ht	235855
858 9.2 Ah	861 9.1 Kl	852 9.3 Ch	878 8.6 Bl	854[12.9 En	852 13.8 Wn
863 9.3 Ah	864 9.1 Kl	856 9.6 Lj	879 8.7 Jo	861 15.0 Dr	862 13.6 L
866 9.5 Ah	885 9.3 L	861 9.7 Lj	883 8.8 Tf	861 15.1 Dw	885 13.3 L
867 9.5 Ah	888 9.5 Wn	864 9.9 Lj	885 8.5 L	R CAS	888 13.0 Wn
872 9.7 Ah	S PEG	867 10.0 Lj	887 8.5 Pt	235350	SV AND
873 9.7 Ah	231508	870 10.1 Lj	893 8.6 Jo	852 10.8 Wn	235939
878 9.9 Ah	852 10.6 Ch	879 10.0 Lj	895 8.5 Sp		887 12.2 Pt
	861 10.7 L				

RAPIDLY VARYING IRREGULAR VARIABLES.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	Star	J.D.	Est.Obs.	J.D.	Est.Obs.
005840 RX ANDROMEDAE—					074922 U GEMINORUM—				
	5868.9	11.7 Pt	5885.7	11.5 Pt		5856.6	13.3 L	5869.9	12.4 Pt
	5870.9	11.6 Pt	5886.7	11.5 Pt		5857.6	12.4 L	5870.6	13.7 L
	5871.9	11.6 Pt	5887.7	11.4 Pt		5858.6	12.4 L	5871.6	13.3 L
	5878.7	12.5 Pt	5888.9	11.6 Pt		5859.6	13.3 L	5875.6	12.4 L
	5881.7	13.3 Br	5889.9	11.7 Pt		5860.6	13.7 L	5876.6	13.3 L
	5883.7	11.6 Br	5890.8	12.5 Pt		5861.6	13.7 L	5883.6	14.0 L
	5883.7	11.5 Pt	5892.7	13.0 Pt		5862.6	13.3 L	5884.6	13.9 L
						5864.6	14.0 L	5885.9	12.4 Pt
010884 RU CEPHEI—						5865.6	13.7 L	5888.9	12.4 Pt
	5859.6	8.9 L	5875.6	9.0 L		5866.6	13.3 L	5889.9	12.4 Pt
	5866.6	8.8 L				5867.6	13.7 L	5890.8	12.4 Pt
060547 SS AURIGAE—						5868.9	12.4 Pt	5891.8	12.3 Ae
	5856.6	14.5 L	5871.6	13.3 L	081473 Z CAMELOPARDALIS—				
	5857.6	14.5 L	5875.6	12.4 L		5856.4	12.6 L	5867.3	12.9 L
	5858.6	12.4 L	5876.6	13.3 L		5856.6	12.9 L	5867.6	12.9 L
	5859.6	14.5 L	5877.4	12.0 L		5857.3	12.9 L	5868.5	12.9 L
	5860.6	14.5 L	5883.4	13.3 L		5858.6	12.9 L	5869.5	12.9 L
	5861.6	14.8 L	5884.4	13.9 L		5859.4	12.9 L	5870.6	11.2 L
	5862.6	14.5 L	5884.6	14.8 L		5859.6	13.1 L	5871.6	11.1 L
	5864.7	13.0 L	5885.5	14.5 L		5860.6	12.9 L	5871.3	11.1 L
	5865.6	13.9 L	5887.7	12.0 Pt		5861.4	13.1 L	5874.4	11.2 L
	5866.6	15.0 L	5888.9	12.6 Pt		5861.6	12.8 L	5875.6	11.5 L
	5867.6	14.5 L	5890.9	12.6 Pt		5862.4	12.4 L	5875.3	11.4 L
	5868.5	14.5 L	5893.7	13.9 Lg		5864.6	12.8 L	5876.6	11.5 L
	5869.9	12.6 Pt	5895.7	11.6 Sp		5865.6	12.6 L	5876.4	11.6 L
	5870.9	12.6 Pt				5866.6	13.0 L	5877.3	11.7 L

RAPIDLY VARYING IRREGULAR VARIABLES.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
081473 Z CAMELOPARDALIS—				
	5879.3	11.4 L	5884.6	11.7 L
	5881.4	11.3 L	5885.5	11.7 L
	5883.4	11.4 L		
094512 X LEONIS—				
	5883.7	[12.8 L		
202946 SZ CYGNI—				
	5868.9	9.1 Pt	5883.7	9.4 Pt
	5869.7	8.8 Pt	5885.7	9.0 Pt
	5870.7	8.9 Pt	5886.7	9.2 Pt
	5871.9	8.9 Pt	5887.7	9.2 Pt
	5872.7	9.0 Pt	5888.9	9.0 Pt
	5873.7	9.0 Pt	5889.9	9.0 Pt
	5875.7	9.4 Pt	5890.7	9.4 Pt
	5877.9	9.6 Pt	5892.7	9.5 Pt
	5878.7	9.6 Pt	5893.7	9.6 Pt
213843 SS CYGNI—				
	5845.1	11.8 Ch	5862.6	11.4 L
	5852.1	11.3 Ch	5863.3	11.5 Lj
	5852.8	12.0 Wn	5863.5	11.6 Ah
	5853.1	11.6 Ch	5864.3	11.9 Lj
	5854.1	11.9 Ch	5864.6	11.7 L
	5856.3	11.9 Lj	5865.3	11.9 Lj
	5856.4	11.5 L	5865.5	11.9 Ah
	5856.6	12.0 L	5865.6	11.9 L
	5857.3	11.3 L	5866.2	11.5 L
	5857.3	11.9 Lj	5866.3	11.8 Ah
	5857.5	11.9 Ah	5866.3	11.6 Lj
	5857.6	11.9 L	5866.6	11.5 L
	5858.3	11.9 Lj	5867.2	10.7 L
	5858.6	12.0 L	5867.3	10.7 L
	5859.3	11.7 Lj	5867.3	11.7 Ah
	5859.3	11.5 L	5867.3	11.3 Lj
	5859.5	11.8 Ah	5867.6	11.3 L
	5859.6	12.0 L	5868.5	11.5 L
	5860.6	11.6 L	5868.7	11.8 Br
	5861.3	11.5 L	5868.9	11.6 Pt
	5861.3	11.8 Lj	5869.3	11.6 Lj
	5861.6	11.5 L	5869.5	11.6 L
	5862.1	11.2 Ch	5869.7	11.1 Br
	5862.3	11.5 L	5869.7	11.7 Pt
	5862.3	11.4 Lj	5870.3	10.8 Lj
213843 SS CYGNI—				
	5870.4	10.9 L	5880.7	8.6 Mg
	5870.6	11.0 L	5881.3	8.9 L
	5870.6	10.6 Lj	5881.3	8.7 Lj
	5870.7	10.4 Br	5881.5	8.9 Ah
	5870.7	11.5 Pt	5881.7	8.8 Br
	5871.3	8.7 Lj	5882.3	8.9 Ah
	5871.3	8.7 Ah	5882.3	9.1 Lj
	5871.6	8.7 L	5882.7	9.0 Sd
	5871.7	8.5 Br	5882.7	8.7 Mg
	5871.9	8.7 Pt	5882.7	8.9 Br
	5872.3	8.4 Ah	5883.2	9.5 L
	5872.7	8.3 Pt	5883.3	9.2 Ah
	5873.3	8.3 Ah	5883.3	9.2 Lj
	5873.7	8.4 Pt	5883.6	8.7 Hs
	5874.3	8.2 L	5883.7	9.6 Pt
	5874.6	8.5 Ae	5883.7	9.2 Br
	5875.4	8.5 L	5884.3	9.7 Lj
	5875.6	8.5 L	5884.4	9.8 Ah
	5875.6	8.5 Ae	5884.4	9.5 L
	5875.7	8.5 Pt	5884.8	9.8 Md
	5876.1	8.2 Ch	5885.2	9.7 L
	5876.3	8.3 L	5885.3	10.2 Lj
	5876.5	8.2 Ae	5885.3	10.1 Ah
	5876.6	8.4 L	5885.6	9.9 Sd
	5877.4	8.3 L	5885.7	10.4 Pt
	5877.5	8.4 Sp	5886.7	10.8 Pt
	5877.6	8.2 Sd	5886.7	10.3 Br
	5877.7	8.5 Pt	5887.7	11.0 Pt
	5878.3	8.5 Ah	5888.6	10.7 Hs
	5878.6	8.5 Ae	5888.9	11.5 Pt
	5878.6	8.6 Wa	5890.7	11.7 Pt
	5878.7	8.4 Pt	5890.7	11.6 Wn
	5879.1	8.3 Ch	5891.7	11.5 Br
	5879.3	8.6 L	5892.7	11.6 Pt
	5879.3	8.5 Ah	5893.7	11.1 Lg
	5879.3	8.7 Lj	5893.7	11.9 Jo
	5879.6	8.7 Ae	5893.7	11.7 Pt
	5879.7	8.5 Sd	5894.7	11.3 Lg
	5880.3	8.7 Lj	5895.7	11.8 Sp
	5880.3	8.7 Ah	5897.7	11.8 Br
	5880.6	8.3 Hs	5907.8	11.5 Md
	5880.7	8.8 Br		

MONTHLY SUMMARY FOR OCTOBER, 1929.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Allen, L. B.	Ae	2	6	Ensor	En	43	53
Ahnert	Ah	30	315	Gaebler	Gb	6	6
Baldwin	Bl	93	313	Gregory	Gy	5	7
Beyer	By	4	31	Grossman	Ga	10	12
Boutell	BL	5	38	Haas	Ha	9	33
Brocchi	Br	27	38	Houghton	Ht	55	134
Brown	Bn	2	2	Jones	Jo	33	93
Buckstaff	Bc	5	19	Kanda	Kd	10	57
Chandra	Ch	73	89	Kohl	Kl	7	40
Dartayet	Dr	85	164	Lacchini	L	178	540
Dawson	Dw	10	12	Leiner	Lj	14	146

MONTHLY SUMMARY—Continued.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Logan	Lg	39	43	Spears	Sp	16	23
Millard	Md	13	19	Taffara	Tf	14	40
Monnig	Mg	11	12	Watson	Wa	5	5
Peltier	Pt	170	297	Webb	Wd	9	26
Sanders	Sd	11	20	Wilson	Wn	40	57
Smith, F. W.	Sf	7	10				
Smith, W. H.	Sm	47	50	Totals		34	406 2758

SUMMARY OF ANNUAL REPORTS, 1912-1929.

Year	Observations	Variables	Observers
1912	6,180	175	19
1913	12,914	200	20
1914	14,506	255	28
1915	14,724	282	29
1916	11,261	290	30
1917	15,788	332	43
1918	16,112	380	34
1919	8,710	352	53
1920	9,099	399	69
1921	15,513	386	77
1922	16,994	372	72
1923	17,745	441	68
1924	19,484	450	70
1925	23,375	439	68
1926	17,990	434	74
1927	17,600	470	75
1928	23,144	500	78
1929	27,218	510	61
Totals	288,257	530	350

ANNUAL REPORT OF THE AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS FOR THE YEAR ENDING OCTOBER 31, 1929.

Observer	Initial	November	December	January	February	March	April	May-June	July-Aug.	September	October	Totals
Ahnert	Ah	137	114	92	237	239	148	430	170	337	315	2219
Allen, P. R.	Al	..	..	13	48	6	..	8	..	..	..	75
Ancarani	An	..	89	47	37	..	23	48	40	108	..	392
Baldwin	Bl	216	198	176	188	..	294	349	430	199	313	2363
Benini	Be	..	11	..	..	..	16	78	42	7	..	154
Beyer	By	128	38	59	48	50	..	144	74	..	31	572
Bigelow	Bw	11	25	18	33	20	..	25	47	..	..	179
Bouton	B	91	84	52	89	74	90	94	..	..	..	574
Boutell	BL	..	..	9	26	19	21	68	27	22	38	230
Brocchi	Br	..	..	..	..	..	16	25	105	84	38	268
Brown	Bn	8	5	9	5	6	..	7	17	7	2	66
Buckstaff	Bc	..	..	..	..	..	..	..	43	..	19	62
Chandra	Ch	165	156	170	129	98	165	75	182	85	89	1314
Dartayet	Dr	148	165	198	188	185	166	300	310	105	164	1929
Dawson	Dw	20	50	17	16	..	35	120	18	11	12	299
Ebert, M.	Eb	8	..	..	15	..	..	15	..	..	..	38
Ensor	En	96	78	54	79	76	57	247	210	83	53	1033
Ford	Fd	..	9	..	8	..	..	..	11	86	..	114
Gaebler	Gb	1	5	2	3	3	2	13	17	8	6	60

ANNUAL REPORT—Continued.

Observer	Initial	November	December	January	February	March	April	May-June	July-Aug.	September	October	Totals
Gallanti	Gt	..	15	..	..	..	..	..	29	82	..	126
Georgetown Coll.	GC	..	..	..	..	135	..	55	41	..	..	251
Gregory	Gy	12	..	..	..	..	2	3	19	5	7	44
Guiler	Gi	14	13	8	11	..	..	..	..	..	..	46
Haas	Hs	5	..	..	..	..	..	10	25	..	33	73
Houghton	Ht	97	79	48	65	101	97	101	257	46	134	1025
Jones	Jo	33	5	12	46	4	14	69	220	99	93	595
Kanamori	Kn	..	..	8	..	..	..	13	6	..	..	27
Kanda	Kd	..	..	68	..	..	..	81	72	..	57	278
Kohl	Kl	..	15	16	26	11	19	15	..	..	40	142
Kurtz	Kz	6	11	2	15	19	4	15	..	..	..	72
Lacchini	L	399	338	389	433	359	360	895	522	576	540	4811
Leiner	Lj	99	60	36	32	33	76	151	203	130	146	966
Logan	Lg	54	107	42	116	166	52	66	124	12	43	782
Millard	Md	..	..	..	..	..	..	..	20	..	19	39
Monnig	Mg	..	..	..	..	..	..	..	20	..	12	32
Nizamiah	Nz	30	53	144	..	47	56	67	168	..	..	566
Peltier	Pt	258	250	219	245	216	220	385	469	263	297	2822
Rajchl	Rj	..	41	..	..	..	..	..	..	..	..	41
Sanders	Sd	..	..	..	..	..	..	..	13	10	20	43
Schoenfeld	Sc	48	32	..	..	..	..	10	31	..	..	121
Smith, F. W.	Sf	42	37	44	49	24	24	29	44	16	10	319
Smith, W. H.	Sm	..	92	59	72	38	66	31	76	11	50	495
Soberanes	Sb	21	26	24	25	3	2	3	1	..	..	105
Spears	Sp	53	18	8	..	..	..	11	39	..	23	152
Swanson	Sw	18	9	..	..	..	..	27	31	..	..	85
Taffara	Tf	..	..	..	..	..	..	..	..	35	40	75
Taylor	Ty	..	..	..	..	..	23	46	30	..	..	99
Waterfield	Wf	6	5	5	3	..	..	..	5	..	..	24
Webb	Wb	30	15	4	9	17	12	36	83	24	26	256
Whitney	Wy	18	48	142	55	110	7	..	..	..	..	380
Wilson	Wn	..	..	2	7	6	17	39	51	..	57	179
10 Others		51	4	11	10	..	8	1	5	5	19	114
Totals	61	2323	2301	2207	2368	2065	2092	4205	4402	2493	2758	27,218

interest and indicated real progress in almost every phase of the Association's activities.

The papers presented by members and guests were of a high order and provoked more than passing discussion. The main address of the afternoon session was by Professor Svein Rosseland, who lectured on the Aurora Borealis. At the Saturday evening session, held in the form of a banquet at the Commander Hotel in Cambridge, Professor Shapley reviewed the principal events in Astronomy during 1929. The following papers were presented:

Occultations of 1928 ..... Ernest W. Brown
Comparison of 1920-24 B.A.A. and A.A.V.S.O. Observations..... Leon Campbell
A.A.V.S.O. Activities in Texas ..... J. H. Logan
The Variable Star TU Cassiopeiae..... Helen B. Sawyer
Junior Astronomical Clubs ..... Leah B. Allen
An Astronomical Museum ..... R. N. Buckstaff
Peculiarities of Certain Short Period Variables..... L. V. Robinson
The Variable with the Shortest Known Period ..... Margaret Harwood
Movie Reel of the 1928 A.A.V.S.O. Meeting ..... L. J. Boss

Twenty-two new members were elected at this meeting, making a total of forty-three for the year just ended.

The following officers for the ensuing year were chosen by the Council:

President.....Alice H. Farnsworth
Vice-President.....Harriet E. Bigelow
Secretary.....Wm. Tyler Olcott
Treasurer.....M. J. Jordan

Professor Ernest W. Brown was elected a new member of the Council.

The 1930 Spring Meeting will be held at the Maria Mitchell Observatory in Nantucket on the invitation of Miss Margaret Harwood.

The monthly report here presented is one of the longest issued in many a month. It indicates close application of our observers to the problems confronting them, and gives us renewed courage to continue as in the past.

This has been the banner year for observing by the Association, not only from the standpoint of quantity but quality. The distribution of the observations has been much more equable and gaps in the resultant light curves have been considerably lessened. Not so many individuals have taken part in the actual observing program, but those who have been in this active class have been much more consistent as well as persistent. The value of coöperation in observing has been more clearly demonstrated during this past year than in any previous year. It is hoped that the coming year may be one of even greater success to the Association, collectively and individually.

LEON CAMPBELL, Recording Secretary.

November 6, 1929.

METEOR NOTES.

By CHARLES P. OLIVIER.

The work of the American Meteor Society has increased so much during the past year or two that now it is nothing unusual to have more observations reported by our members in a single month than we used to have in a whole year. It can further be said that we have a number of trained observers who take the greatest interest in their work, as well as the larger group who report more occasionally. The annual report for 1929 will not be prepared before next February, as we desire our most distant observers in the Southern Hemisphere to have a chance to send in their latest observations made during the current year.

The volume of work is now so great that the writer cannot alone keep up with it, but he hopes in the near future to have some trained assistance, which will permit him to keep abreast of the reports. Therefore, few radiants have been deduced recently by him, though large numbers of excellent radiants exist on many of the maps now on file. In M 4 the last radiant had the serial number 1541. Many radiants have since been published in "Meteor Notes" with the observer's private number. The writer, in the near future, will assign an A.M.S. serial number to those already published, and will publish a key thereto. In this paper the A.M.S. serial numbers begin at 2000 and will hereafter run consecutively.

Very many good observations have been reported by the Texas group. As they all live in or very near to Ft. Worth or Dallas, the observations were made in that immediate region. However, as the observers occupied several different

stations, for parallax work, it has seemed needless here to designate exactly where each was on every night. Mr. Bunch, on November 10, observed at Knoxville, Tennessee; in all other cases they observed in the part of Texas designated.

Special attention should be called to the fine series of radiants of the Delta Aquarids derived by McIntosh. He not only secured sharp radiant points, but his work proves the eastward daily shift, as can be readily seen. To the writer's knowledge the shift has never before been proved, so McIntosh should have the credit of its discovery. He was further able to get six radiants for the shower in Piscis Australis, somewhat farther south, whose members are often confused with the Aquarids. He also reports a striking resemblance between the orbit of Comet 1881 V and that from his radiant No. 2026. The following are his figures, which have not been checked by the writer. The latter finds that radiants No. 1076 and 1078 in M 3 approximately fit this position. The parabolic orbit for No. 1078 may be found therein, and is here added as a confirmation of McIntosh's work.

DELTA AQUARID RADIANTS.

A.M.S. No.	Date	α	δ	Meteors
2001	1929 July 26.67	339°6	—17°0	5
2002	28.66	341.0	—16.5	8
2003	30.65	343.5	—15.5	12
2009	31.71	344.5	—15.0	9
2015	Aug. 1.69	345.7	—14.5	19
2032	3.66	347.3	—13.7	17
2042	4.66	348.5	—13.3	10
2048	8.67	352.3	—11.5	8

	Comet 1881 V	No. 2026 (Parab.)	No. 2026 (Ellip.)	No. 1078 (Parab.)
a	4.2815	∞	4.2815	∞
e	0.8304	1.0	0.8453	1.0
q	0.7259	0.6306	0.6624	0.545
i	6°9	7°2	6°3	11°6
☊	65.9	130.8	130.8	121.9
π	18.6	26.7	26.8	27.6

The Orionid and Leonid showers are now over. Bright moonlight spoiled their maxima. To date, the only reports received on the former are from F. W. Smith, B. C. Darling, and R. Tilburt. These show a very low hourly rate, as was almost inevitable. As for the Leonids, already reports are in from R. H. Axtell, S. Bunch, L. Lawsine, F. W. Smith, B. S. Whitney, and the staff at Flower Observatory. The Texas group reports clouds for November 10 and 11 and so does H. B. Ransom of Jacksonville, Florida, on November 13 and 14, when he saw no meteors in the few clear spaces during those nights. The only interesting thing so far noted is that undoubted Leonids appeared as early as November 9. On November 15, it was wonderfully clear at Flower Observatory, and the writer personally observed. Had there been any appreciable number of Leonids, the moonlight would not have prevented those of the third magnitude from being seen. So unless they came in numbers on November 13, 14, or 16, when it was cloudy here, we may assume that this year's display was far inferior to that of 1928. However, the stream seems to be getting wider, if not denser. Of course, most reports have not yet arrived, so we may have to modify our remarks later.

The Geminids, with a maximum about December 11, and the Quadrantids, January 1 to 4 inclusive, are the only remaining showers of any importance until spring. Our members are asked to watch for both, as moonlight will interfere far less for the Geminids, and not at all for the Quadrantids. The former give one of the best showers of the whole year.

We welcome the following new members:

Dan S. Waugh, *27* Kami-Nibancho, Tokyo, Japan.

Mrs. Guy W. Oliver, Price Rd., R. 2, Box 1016, Clayton, Missouri.

Travis Hoke, 381 Fourth Avenue, New York City.

Vernie John Niebuhr, Reedsburg, Wisconsin.

B. C. Darling, Lansing, Michigan.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Sept. 7	8:32	9:26	54	2	0.9	2.2	2.4	
11	8:49	10:17	88	6	0.9	4.1	4.6	
14	8:30	16:50	117	7	...	3.6	...	At intervals
27	8:30	9:46	76	6	0.9	4.7	5.2	
27	10:55	11:30	35	0	0.9	0.0	0.0	
30	9:25	10:36	71	7	1.0	5.9	5.9	
Oct. 4	10:25	12:16	121	10	1.0	4.9	4.9	2 more
7	9:02	9:45	43	2	0.7	2.8	4.0	
8	9:30	10:35	65	6	1.0	5.6	5.6	
13	14:02	14:34	32	4	0.8	7.5	9.4	
14	10:28	11:44	76	4	0.5	3.1	6.2	Moon gibbous
16	12:30	14:52	142	16	0.7	6.8	9.7	Moon gibbous
17	12:00	15:07	187	14	0.6	4.5	7.5	Moon nearly full
19	11:15	12:25	70	1	0.3	0.9	[3.]	Moon full
26	12:00	13:33	93	6	1.0	3.9	3.9	
27	8:45	10:31	91	7	1.0	4.6	4.6	

R. Tilburt, Lansing, Michigan.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Oct. 16	12:30	14:52	142	4	0.7	1.7	2.4	
17	12:05	15:07	182	16	0.6	5.3	8.8	

Franklyn W. Smith, Glen Olden, Pennsylvania.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Oct. 16	16:50	17:20	30	6	1.0	12.0	12.0	4 Orionids
25	9:00	10:30	90	4	1.0	2.7	2.7	
26	12:15	13:00	45	2	...	2.7	...	
Nov. 9	15:30	16:00	30	3	1.0	6.0	6.0	
11	16:15	17:00	45	2	1.0	2.7	2.7	
15	14:50	16:00	70	4	0.4	3.4	[8.5]	Full moon

C. P. Olivier, Flower Observatory, Pennsylvania.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Nov. 9	14:30	16:33	120	10	0.8	5.0	6.2	2 Leonids, 1 other?
15	13:10	17:50	135	8	0.4	3.6	[9.0]	Moon full
11	14:55	15:40	45	2	1.0	2.7	2.7	Leonids, by Mason
15	11:45	13:00	75	1	0.2	...	...	Fireball, " "

R. A. McIntosh, Auckland, New Zealand.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
July 27	2:45	4:30	105	17	0.3	9.8	[32.7]	
29	2:40	4:10	57	20	0.5	21.0	42.0	2 more meteors
31	2:22	3:48	71	21	0.6	18.0	30.0	2 more meteors
Aug. 1	3:30	5:30	120	47	0.8	23.5	29.4	4 more meteors
2	2:30	5:30	180	65	0.9	21.7	24.1	2 more meteors
4	1:10	5:30	260	99	1.0	22.9	22.9	4 more meteors
5	2:25	4:20	110	50	1.0	27.0	27.0	4 more meteors
9	2:30	4:30	120	39	1.0	19.5	19.5	2 more meteors
13	2:44	4:45	121	36	0.9	17.8	19.8	5 more meteors
14	2:44	4:15	91	23	0.8	15.0	18.8	1 more meteor
				417				26
				26				
Total				443				

R. H. Axtell, Lewiston, Maine.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Nov. 9	15:35	16:30	55	13	0.7	14.1	20.1	1 Leonid, 2 others?

B. S. Whitney, Miami, Oklahoma.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Aug. 15	14:00	16:00	120	32	1.0	16.0	16.0	
16	9:15	11:15	120	6	0.4	3.0	[7.5]	
27	9:35	10:35	60	13	1.0	13.0	13.0	Counts
	10:35	11:10	35	5	1.0	8.6	8.6	Counts
Nov. 10	16:55	18:10	75	24	1.0	19.2	19.2	16 pltd., 8 Leods.
Aug. 15	14:00	15:00	60	37	1.0	37.0	37.0	Counts by G. W.
	15:00	16:00	60	28	1.0	28.0	28.0	Counts by G. W.

Mrs. Henry Van Allen, Silver Springs, New York.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Aug. 11	10:25	11:20	55	30	...	32.6	...	Counts; in N. E.

Leo Lawsine and William Tessler, Malden, Massachusetts.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Nov. 15	11:05	13:15	130	15	...	...	...	Paths of 10 dscrbd.

TEXAS GROUP.

Sterling Bunch.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
July 27	9:00	12:45	225	49	0.8	13.1	16.4	
27	9:08	10:56	108	11	0.8	6.1	7.6	Additional by
28	9:05	11:10	125	20	0.8	9.6	12.0	[Mrs. Bunch
Aug. 3	9:19	13:07	228	45	0.7	11.8	16.9	
3	9:19	12:23	184	36	0.7	11.7	16.7	By 3 assistants
8	9:40	13:55	255	66	0.8	15.5	19.4	
10	11:19	15:40	97	25	1.0	15.4	15.4	
Nov. 9	11:37	15:25	228	47	0.8	12.4	15.5	10 prob. Leonids
								[at Nashville, Tenn.

J. H. Logan.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
July 25	8:35	9:40	65	5	0.8	4.6	5.8	
27	8:42	12:00	194	25	1.0	7.7	7.7	
Aug. 10	9:00	16:00	...	57	1.0	...	...	
Sept. 1	11:00	13:38	158	31	1.0	11.8	11.8	

O. E. Monnig.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
July 26	8:44	11:25	161	14	0.9	5.2	5.8	
27	8:58	12:04	186	36	0.8	11.6	14.5	
28	9:05	12:20	178	30	0.8	10.1	12.6	
31	10:15	12:42	147	32	0.8	13.1	16.4	
Aug. 2	9:00	10:00	60	7	0.8	7.0	8.8	
3	9:32	14:06	274	65	1.0	14.2	14.2	
5	10:17	13:20	183	48	0.8	15.7	19.6	
5	10:45	11:45	60	11	0.8	11.0	13.8	
6	11:00	13:30	150	34	0.8	13.6	17.0	
7	9:15	12:25	190	31	0.8	9.8	12.2	
10	11:08	15:40	153	79	1.0	31.0	31.0	
11	12:25	14:38	56	48	1.0	51.6	51.6	
Sept. 1	12:44	15:53	97	21	1.0	13.0	13.0	

Robert Brown.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
July 27	8:48	11:59	191	36	0.8	11.3	14.1	
Aug. 7	9:15	12:25	190	17	0.8	5.4	6.8	

BLAKENEY SANDERS.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
July 27	9:00	12:04	184	37	0.8	12.1	15.1	
Aug. 3	9:34	14:06	272	52	1.0	11.5	11.5	
10	9:10	14:36	...	33	1.0	....	....	

LYCURGUS VAN ZANDT.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Aug. 3	9:30	10:30	60	5	1.0	5.0	5.0	
10	9:45	11:45	120	10	1.0	10.0	10.0	

VIRGINIA VAN OSDOL.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Aug. 8	9:18	14:54	?	23	0.8			
10	11:55	13:40	?	8	1.0			
11	10:08	10:20	?	4	1.0			
12	9:10	13:31	?	16				

MISS LUCILE STEVENS AND MISS C. M. NOBLE.

1929	Began	Ended	Total	Meteors	F	Rate	Cor.Rate	Notes
Aug. 10	9:15	13:15	?	41	1.0			
11	7:42	9:35	?	6	1.0			

RADIANTS BY R. A. MCINTOSH.

A.M.S. No.	1929	R.A. °	Dec. °	Meteors	Wt.	Remarks
2000	July 26.67	337.0	—33.0	4	Poor	See 2008, 2014, 2031, 2041, 2047. Position depends on 1 doubtful path
2001	July 26.67	339.6	—17.0	5	Good	δ Aquarids. See 2002, 2003, 2009, 2014, 2032, 2042, 2048.
2002	July 28.66	341.0	—16.5	8	Good	δ Aquarids. See 2001, 2003, 2009, 2014, 2032, 2042, 2048.
2003	July 20.65	343.5	—15.5	12	Ex.	δ Aquarids. See 2001, 2002, 2009, 2014, 2032, 2042, 2048.
2004	July 31.71	6.0	—20.0	3	Fair	See 2010, 2017, 2019, 2033.
2005	July 31.71	33.0	—14.5	3	Poor	
2006	July 31.71	49.0	—22.0	4	Good	
2007	July 31.71	66.0	—42.0	4	Poor	See 2013.
2008	July 31.71	342.0	—33.0	9	Fair	See 2000, 2014, 2031, 2041, 2047.
2009	July 31.71	344.5	—15.0	9	Good	δ Aquarids. See 2001, 2002, 2003, 2015, 2032, 2042, 2048.
2010	Aug. 1.69	7.5	—21.0	5-7	Good	See 2004, 2017, 2019, 2033.
2011	Aug. 1.69	52.0	—24.0	3	Poor	
2012	Aug. 1.69	54.0	+ 1.0	4	Fair	See 2024.
2013	Aug. 1.69	64.0	—41.5	4-6	Fair	See 2007.
2014	Aug. 1.69	342.6	—32.2	5	Good	See 2000, 2008, 2031, 2041, 2047.
2015	Aug. 1.69	345.7	—14.5	19	Ex.	δ Aquarids. See 2001, 2002, 2003, 2009, 2032, 2042, 2047.
2016	Aug. 1.69	350.5	+ 2.5	6-7	Good	1 meteor on July 31.
2017	Aug. 1.69	359.0	—21.0	3-4	Good	See 2004, 2019, 2033.
2018	Aug. 1-3c	67.0	—31.0	4	Good	2 meteors Aug. 1; 2 on Aug. 3.
2019	Aug. 3.66	2.5	—20.0	4-6	Fair	See 2004, 2010, 2017, 2032.
2020	Aug. 3.66	22.0	+18.0	3	Poor	See 2035.
2021	Aug. 3.66	27.0	+21.0	5	Fair	1 meteor Aug. 1; 1 on Aug. 4.
2022	Aug. 3.66	39.5	—15.5	9-10	Good	See 2036.
2023	Aug. 3.66	48.0	—21.0	5-6	Good	See 2038.
2024	Aug. 3.66	55.0	+ 2.0	3	Fair	See 2012.
2025	Aug. 3.66	75.0	—41.0	4	Fair	See 2007(?), 2013.
2026	Aug. 3.66	303.5	—10.5	7	Ex.	See 2059, 2062, 2039.
2027	Aug. 3.66	319.0	—16.0	6	Good	
2028	Aug. 3.66	324.0	—23.0	7	Poor	
2029	Aug. 3.66	335.0	—45.5	3	Fair	

RADIANTS BY R. A. MCINTOSH—Continued.

			°	°			
2030	Aug.	3.66	337.5	+12.5	4	Good	1 meteor Aug. 1.
2031	Aug.	3.66	346.0	—33.0	12	Good	See 2000, 2008, 2014, 2041, 2047.
2032	Aug.	3.66	347.3	—13.7	17	Ex.	δ Aquarids. See 2001, 2002, 2003, 2009, 2015, 2042, 2048.
2033	Aug.	4.66	0.5	—23.5	4	Fair	See 2004, 2010, 2017, 2019.
2034	Aug.	4.66	9.0	—12.5	5	Good	
2035	Aug.	4.66	23.0	+16.0	3	Fair	See 2020.
2036	Aug.	4.66	39.0	—16.0	4-5	Good	See 2022.
2037	Aug.	4.66	39.0	+ 1.0	3	Fair	
2038	Aug.	4.66	49.0	—21.0	2-3	Fair	See 2023.
2039	Aug.	4.66	304.0	—10.5	2	Fair	See 2059, 2062, 2036.
2040	Aug.	4.66	333.5	— 0.5	4	Fair	1 stationary meteor.
2041	Aug.	4.66	347.0	—33.0	4	?	No accurate paths seen. See 2000, 2008, 2014, 2031, 2047.
2042	Aug.	4.66	348.5	—13.3	10	Ex.	δ Aquarids. See 2001, 2002, 2003, 2009, 2015, 2032, 2048.
2043	Aug.	8.67	6.0	+12.5	4	Good	
2044	Aug.	8.67	43.5	—27.0	4	Good	
2045	Aug.	8.67	271.0	—34.5	1	Good	1 stationary meteor.
2046	Aug.	8.67	321.0	— 6.0	3	Fair	
2047	Aug.	8.67	350.0	—30.5	5	Good	See 2000, 2008, 2014, 2031, 2041.
2048	Aug.	8.67	352.3	—11.5	8	Ex.	δ Aquarids. See 2001, 2002, 2003, 2009, 2015, 2032, 2042.
2049	Aug.	12.68	9.5	—14.0	3-4	Good	
2050	Aug.	12.68	22.5	— 7.5	4-5	Good	
2051	Aug.	12.68	80.0	—42.5	4	Fair	1 meteor Aug. 13.
2052	Aug.	12.68	326.0	—35.4	5	Ex.	1 meteor Aug. 13.
2053	Aug.	12.68	330.7	—13.4	5	Good	
2054	Aug.	12.68	350.0	—21.5	1	Good	1 stationary meteor. See 2056.
2055	Aug.	13.67	350.0	—60.0	3	Poor	
2056	Aug.	13.67	350.0	—22.0	2-4	Fair	See 2054.
2057	Aug.	12-13c	2.5	—36.0	6	Good	
2058	Aug.	12-13c	14.0	—42.0	6	Poor	

UNCERTAIN RADIANTS.

A.M.S. No.	1929		R.A.	Dec.	Meteors	Wt.	Remarks
2059	July	28.66	294	—14	2	?	See 2062.
2060	July	30.65	343	—28	2	?	
2061	July	31.71	16	± 0	2	?	
2062	July	31.71	31	— 5	2	?	
2063	Aug.	1.69	309	—14	2	?	See 2059. 3 meteors July 31 also.
2064	Aug.	12-13c	57	— 2	2-4	?	

RADIANTS BY C. B. FORD.

A.M.S. No.	1929		R.A.	Dec.	Meteors	Wt.	Remarks
2065	July	31	19	+48	3	Poor	See 1235.
2066	Aug.	4	38	+54.5	16	Good	Perseids.
2067	Aug.	7	44	+54	8	Good	Perseids.
2068	Aug.	11	45	+54	28+	Good	Perseids.
2069	Aug.	9	46	+55	19	Good	Perseids.
2070	July	25	269	— 8	2	Fair	⎫
2071	July	27	274	— 4.5	3	Fair	⎭ Combine
2072	July	28	311	—14	4	Good	
2073	July	31	325	+25	4	Poor	
2074	July	28	332	—20	4+	Fair	
2075	July	31	337	— 8	11	Fair	δ Aquarids; large area.
2076	Aug.	3	339	—18	3	Good	δ Aquarids.
2077	Aug.	9	339	+42.5	3	Good	
2078	Aug.	4	348	+35	3	Fair	

RADIANTS BY C. P. OLIVIER.

A.M.S. No.	1929	R.A.	Dec.	Meteors	Wt.	Remarks
		°	°			
2079	Nov. 9	149	+23	2	?	Leonids; good in δ, poor in α.
2080	Nov. 15	152.5	+20	4	?	Leonids; good in α, poor in δ.

RADIANTS BY C. P. SCHAFER.

A.M.S. No.	1929	R.A.	Dec.	Meteors	Wt.	Remarks
2081	Sept. 26-29	1	+53	4	Fair	
2082	Oct. 2-3	43	+28	4	Poor	
2083	Oct. 2	43	+57	3	Fair	

RADIANTS BY V. ANYZESKI.

A.M.S. No.	1929	R.A.	Dec.	Meteors	Wt.	Remarks
2084	June 26	218	+52	4	Fair	Pons-Winnecke.
2085	June 27	226	+54	3	Good	Pons-Winnecke.
2086	June 26-27	265	+18	5	Fair	
2087	June 26	266	+21	4	Fair	

RADIANTS BY B. S. WHITNEY.

A.M.S. No.	1929	R.A.	Dec.	Meteors	Wt.	Remarks
2088	Aug. 15	3	+35	3	Poor	See 56, 230, 538.
2089	Aug. 15	4.5	+ 3	5	Fair	
2090	Aug. 15	62	− 4	3	Poor	
2091	Aug. 15	344	+ 9.5	3	Fair	See 1524.
2092	Nov. 10	150	+23	6	Fair	Leonids.
2093	Nov. 10	152	+37	4-5	Good	

Flower Observatory of the University of Pennsylvania,
Upper Darby, Pennsylvania, 1929 November 19.

Fireballs Reported to the University of Iowa.

This is a continuation of the list reported in the November issue of POPULAR ASTRONOMY.

July 10, 9:45. Observed by A. P. Weiss, Professor of Psychology, Ohio State University, Columbus, Ohio. This was a good report, and should have been included in the earlier list. It was omitted because we had only the one report, and the note of G. H. England in the August-September issue, an observation of the same meteor from Fostoria, Ohio, had been overlooked.

October 14 and 15, 1929. These fireballs are listed in a separate note, as a remarkable number of brilliant objects appeared in the space of a few hours.

November 1, 12:00. The *Earlham Echo* reports that near midnight "The meteor first became visible near the meridian just east of the Milky Way." It fell to the south and west leaving a luminous trail, and "For perhaps fifteen seconds all Earlham and its environs were illuminated bright as day." Also "following the disappearance of the flaming orb, the country near Earlham was shaken by a tremble similar to the earthquake 'tremblors' felt so frequently on the coast." Earlham is about 25 miles west and a little south of Des Moines, Iowa. The clipping was received from Chas. D. Reed of the U. S. Weather Bureau at Des Moines, Iowa.

November 2, 7:40. E. M. Letts of Iowa City observed a meteor in the southwestern sky which illuminated the sky much more than the revolving aviation light at the airport a mile away. The meteor was independently reported by Robert N. Wolfe of Fairfield, and Renald Evans of Cedar Rapids. A report from

Keokuk states that a meteor bright enough to cause distinct shadows was seen in the southwest at 9:30. This is being investigated to see whether the time may be inaccurate, and whether perhaps it may be a report of the one observed by Mr. Letts and the others.

November 5, 8:16. R. C. Huffer, Professor of Mathematics of Beloit College, Beloit, Wisconsin, reports that a group of his astronomy students observed a meteor in the northeastern sky. The meteor was described as appearing about one-third the diameter of the moon, bright blue, and with a long yellow tail. A second meteor, less bright but conspicuous, was observed at 9:12 on the same evening, farther to the north.

November 9, 5:58. A meteor observed at Iowa City, Iowa, in the southeastern sky by C. J. Lapp, Professor of Physics at the University of Iowa. This meteor was observed before it was really dark, and may have been bright enough to cause shadows on a moonless night.

FIREBALLS OF OCTOBER 14 AND 15, 1929.

October 14, 16:00, (October 15, 4:00 A.M. Civil Time). At about this hour Mr. Harold W. Gee of Storm Lake, Iowa, noticed a flash of light in his bedroom which he took to be from a car turning a corner. Looking out of his window he saw the trail of a meteor in the northeast. This report was received from David E. Hadden, of Alta, Iowa.

At about the same hour, Wm. A. Schuller of Stockton, Illinois, saw a meteor fall in the north perhaps a little to the east, "brilliant enough to make it as light as day for an instant." This report was received from Father J. A. Theobald, Professor of Mathematics at Columbia College, Dubuque, Iowa.

October 15, 7:15. At Iowa City, the writer, with a university class in astronomy, observed a meteor in the southwestern sky, equal in brightness to Venus at greatest brilliancy.

October 15, 12:00. Joe Bosten, at a point near Muscatine, Iowa, observed a meteor brilliant enough to illuminate the surrounding sky, in the northeast.

At about the same hour Judge H. H. Schaaf, of David City, Nebraska, saw a flaming ball of fire fall in the western sky. This report was received from Dr. Willard J. Fisher of Harvard. Two other observations of this Nebraska meteor have been received directly.

October 15, hour unknown. Observers happened to be awake and noticed meteor from bedroom window.

Mrs. Schwindt, of Dubuque, Iowa, observed a meteor in the southwestern sky which she insists was brighter than the full moon. This report was received from Father Theobald.

Mr. Herman Rekon, of Luana, Iowa, was lying awake facing the north when "suddenly the sky became illuminated," and he "saw three balls of light . . . . travelling toward the northeast . . . leaving no trail . . . but lighting up the earth as they fell." This report was received from Father Theobald.

It will be interesting to know whether bright meteors were seen in other sections of the country on these nights.

University of Iowa. C. C. WYLIE.

Perseids Observed at Ottawa.—The maximum display of the Perseids which took place August 12 was observed here under quite favorable circumstances. The night was practically cloudless and the air still. As we are on the fast time here it was rather difficult during the early part of the night and I did

not observe a single meteor until after 12:00 P.M. which would really be 11:00 P.M. Eastern Standard Time.

During the following half-hour I observed six meteors of great beauty. All came apparently directly from the constellation Perseus and all but one were of the first magnitude or probably slightly brighter.

The first was about magnitude minus one. Then came three of about magnitude one, then a fifth of great beauty. This meteor left a trail of about three or four degrees in length. It was of a brilliant greenish color and instead of fading out or exploding seemed to break up rather gradually into three or four large sparks. A few minutes later came another of about magnitude two. Although I continued my observations for some time afterwards I did not see any more. All six were of a greenish white or greenish color.

Compared with last year's display there were not so many during the earlier part of the night, as last year I saw about thirty to thirty-five in about the same time, but those of this year were much brighter. Last year there was only one of about magnitude one, three or four of about magnitude two, and the remainder were quite faint. Also last year many of those observed appeared low down near the horizon and did not seem to come from the constellation Perseus although the brighter ones did.

G. McFARLANE.

490 Cooper Street, Ottawa, Ontario.

NOTES FROM AMATEURS.

Observations of Uranus.

I would like to put in a plea for the planet Uranus as an interesting object for amateur telescopic observation, provided one has a reasonably good instrument of five or six inches aperture.

One reads occasionally of interesting observations of the motion of Uranus and Neptune among the stars, such observations generally being made with field glasses, but most authorities seem to be in accord with the Reverend T. W. Webb in his statement that "these planets may be reached, but to no great purpose, with ordinary means."

To my mind there is something very fascinating in telescopic observations of both these planets, and particularly Uranus. The appearance of the tiny and yet sharply defined disk is entirely unlike that of the spurious disks of stars, and its color, a rather light green, is remarkable. The disk is not at all "dull" as is so often stated. As a matter of fact, it seems strange that, based upon appearance alone, Uranus was not recognized as a planet long before Herschel's time.

Then, too, the planet's motion from night to night is much more noticeable in the telescope than with field glasses, particularly when the planet is in the neighborhood of only faint stars.

The situation of Uranus is particularly favorable this fall, and I am sure that others will enjoy such views as I have had of it in my 6-inch reflector.

With a real diameter four times that of the earth, Uranus is the fourth largest planet in our system, yet it always seems to me to be a lonesome little object, slowly pursuing its course like a tiny boat on the vast ocean, unheeded by almost all mankind, and yet very likely containing within itself and its peculiar system of satellites answers to some of the most fundamental questions of the origin of the Solar System.

HUGH G. BOUTELL.

3723 Jocelyn Street, Washington. D. C.

COMET NOTES.

By G. VAN BIESBROECK.

According to a telegram from the Tucson Observatory (Ariz.) E. F. Carpenter found on November 12 what seemed to be the image of a faint comet on a plate exposed by him ten days earlier. The position is:

1929 Nov. 2.280 U.T. $\alpha = 2^h\ 25^m\ 2^s$, $\delta = +20^\circ\ 8'\ 57''$
Magnitude 16. Tail 30″. Daily motion +14ˢ and —5′

Although there was only one plate available the direction of the motion could be ascertained by a nearby retrograde asteroid-trail and rapidly deteriorating seeing. The object could not be found on November 13 but the moon was then too bright. No further information has been received. On November 21 and 22 the writer photographed the region indicated but failed to distinguish the object. The position is of course quite doubtful after an interval of three weeks. Unless further evidence is forthcoming the object will have to be regarded as unconfirmed.

F. E. Seagrave sends new elements for Periodic Comet 1913 III (Neujmin) which he has carefully computed from the three distant observations: Sept. 6 by K. Graff at Bergedorf, Nov. 1 and Dec. 30 by E. E. Barnard at the Yerkes Observatory. His results are:

$$\begin{aligned} T &= 1913\ \text{Aug. } 16.43234\ \text{G.M.T.} \\ \omega &= 346^\circ\ 13'\ 57''.09 \\ \Omega &= 347\ \ 54\ \ 46.36 \quad 1913.0 \\ i &= \ \ 14\ \ 50\ \ 25.69 \\ e &= 0.7756994 \\ \text{Log. } q &= 0.1843342 \end{aligned}$$

Period 17.79327 years

This will bring the comet back at its first return to perihelion in the spring of 1931. The above elements, deduced from an interval of nearly four months, evidently give already a close approximation for this prediction. The writer is making a discussion of all the observational material in 1913 in order to find the uncertainty of the elements. I expect to supplement this by a computation of the perturbations for the interval 1913 to 1931 so as to make the prediction as sharp as possible. Theer is a special interest in seeing this comet again at its next return: in 1913 it appeared as a practically stellar nucleus with only a very faint coma, so faint that it remained invisible to many observers, who reported that the comet looked like an asteroid.

At present no known comets are observable in ordinary telescopes. With the 24-inch reflector the writer is still able to follow Comet 1927 *d* (Stearns) two years and nine months after its discovery. Its brightness (Nov. 22) is close to 16ᴹ. As to Comet 1929 *c* (Forbes) it showed very well on plates taken on Nov. 5 and 6; the nucleus had become quite diffuse but the tail was still visible on the following side. The brightness was estimated as of magnitude 15. On Nov. 21 and 22 it had faded to 16ᴹ.5 and appeared so diffuse that is was close to the limit of what can be measured. It is questionable if further observations will be possible.

Williams Bay, Wisconsin, November 23, 1929.

GENERAL NOTES.

Dr. Clyde Fisher, Curator of Astronomy of the American Museum of Natural History, New York City, and president of the Amateur Astronomers Association, delivered an address at the semi-monthly meeting of this Association on November 20. His subject was "Our Place in the Milky Way Galaxy." Dr. Fisher also lectured at the Labor Temple, New York City, on November 9, his subject on this occasion being "Our Evolving Universe."

The Amateur Astronomers Association, whose headquarters are at the American Museum of Natural History, New York City, at its semi-monthly meeting on November 6, had the privilege of seeing motion pictures depicting the Einstein theory of relativity. These pictures were edited and captioned in English by Garrett P. Serviss.

The Department of Astronomy of the Brooklyn Institute of Arts and Sciences recently sponsored two notable lectures. The first was given by Dr. Anton Pannekoek, of the University of Amsterdam, on "Our Nearest Universe." The second was given by Dr. J. S. Plaskett, Director of the Dominion Observatory, Victoria, B. C., on the subject "The Rotation of the Galaxy."

American Astronomical Society.—The preliminary announcement of the forty-third meeting of the American Astronomical Society has been issued by the secretary of the society, Dr. Raymond S. Dugan. This meeting will be held at the Harvard College Observatory from December 30 to January 2. One of the sessions will be held at the Whitin Observatory of Wellesley College. Aside from the usual features of the meetings, an excursion is planned for January 2 to West Lynn to visit the General Electric plant there and in particular to see the work on fused quartz mirrors.

The Amateur Astronomers Association, an unusually active organization in New York City, has announced a most interesting program for the month of December. It consists of two regular meetings of the Association at the American Museum of Natural History on December 4 and December 16. The speakers and their topics will be Dr. John A. Miller on "The Eclipse of 1929," and Dr. John C. Duncan on "The Nebulae."

In addition a series of radio talks has been arranged to be given through station WOR between 5:15 and 5:45 P.M. on the dates given below as follows:

Saturday, Dec. 7, Dr. Clyde Fisher, "Mars, the Ruddy Wanderer of the Sky."
Saturday, Dec. 14, Dr. Clement S. Brainin, "The December Sky."
Saturday, Dec. 21, Dr. Oswald Schlockow, "The Poetry of the Stars."
Saturday, Dec. 28, Mr. Anthony Fiala, "The Friendly Stars of the Polar Night."

Detroit Observatory Notes.—The new spectrohelioscope which was received a few weeks ago has been set up temporarily and is being tested and adjusted by Dr. Curtiss and Mr. Colliau, the instrument maker. Work on the new 15-inch Pyrex reflector is progressing and the instrument should be installed in a few weeks. The mechanical parts were made in the instrument shop of the Observatory. It has a tube only six feet long, but the focal length in the Cassegrain form is 300 inches. A new type of driving clock, involving the use of an electric Telechron motor, is being built for it.

Dr. Sitterly of Middletown, Connecticut, has spent several weeks here working in astrophysics and spectroscopy. He left recently for Chicago, where he expects to visit the Yerkes and Dearborn Observatories.

November 21, 1929.

The A. Cressy Morrison Astronomical Prize. — The New York Academy of Sciences announces a third A. Cressy Morrison prize of $750 to be awarded in December, 1930, for the best paper on solar and stellar energy. Two prizes of a similar nature have already been awarded; the first in December, 1926, to Dr. Donald H. Menzel of Lick Observatory; the second in December, 1928, to Dr. Menzel in collaboration with Dr. P. B. Gerasimovič of Harvard College Observatory.

The Mathematical Association of America.—The fourteenth annual meeting of the Mathematical Association of America will be held at Des Moines, Iowa, on Tuesday, December 31, 1929, and January 1, 1930, in affiliation with the American Association for the Advancement of Science and the American Mathematical Society. The meetings will all be held at the Fort Des Moines Hotel, which has been designated as headquarters for the Mathematical Association and for the American Association.

Zodiacal Light Notes.

A letter has been received from Prof. E. O. Hulburt, Navy Research Laboratory, Anacostia, D. C., which suggests a physical connection between fluctuations in Zodiacal Light and aurorae and magnetic storms. Dates of Chaplain Jones's reports of fluctuations in 1853-1854 have been checked with the result that each instance coincided with unusual magnetic disturbance. Other reports of fluctuations have also been checked with the same result except in one instance. It would seem as if such results were not merely coincidences and if the physical relation suggested really exists it will have an important bearing on Zodiacal Light theory.

Observations.

On October 27 the writer at 11:30 P.M. glimpsed a Zodiacal Light band through Taurus into Aries. The band was quite diffused. Part of it was in the Gegenschein area but the usual shape of the Gegenschein could not be made out. Rather, it presented the appearance of a slightly broadened band, not noticeably roundish. At 12:30 A.M., twenty minutes before moonrise a faint luminosity similar in appearance to the horizon Zodiacal Light was seen in the east.

Morning Zodiacal Light.

At 4:45 A.M., October 28, the morning Zodiacal Light showed faintly extending almost to Praesepe. The presence of the moon in Leo, twenty-five days old, doubtless accounted for the very faint appearance of the Zodiacal Light. Under more favorable conditions the morning Zodiacal Light was observed at 4:45 A.M. on November 6. Against the background of Virgo and Leo the column could be traced to the Sickle where it was abruptly ended by a cloud. A low-lying cloud bank along the horizon prevented the making of an estimate of its breadth there. At 5:15 the Light began to spread laterally as dawn appeared.

In addition to the morning Zodiacal Light, observers will find it profitable to watch the evening Light now coming into view for the winter months. Assistance in these observations is requested. Due credit will be given for all reports received.

W. E. Glanville.

The Rectory, New Market, Maryland.

BOOK REVIEWS.

Cours D'Astronomie, by Jean Bosler. (Hermann and Co., 6 Rue de la Sorbonne, Paris. Price 140 francs.)

This is the third volume in a series which is being published by the Faculty of Sciences of Paris. The preceding volumes are by H. Andoyer on "Theoretical Astronomy," and by H. Andoyer and A. Lambert, on "Practical Astronomy."

The present volume is entitled "Astrophysics." It consists of seven hundred pages and contains numerous illustrations, some of them very recent ones. The volume is divided into four parts. Instruments and Methods, six chapters; The Sun, nine chapters; The Planets, Comets, and Meteors, eight chapters; The Stars and Nebulae, ten chapters. A casual inspection of the book furnishes the impression that the subject is treated in a very exhaustive manner. The illustrations are printed on special paper, and fulfill a very useful purpose in the presentation. This, no doubt, will be regarded as a standard work on this subject for years to come. The fact that it is in the French language makes little difference, for anyone trained in scientific work is necessarily master of several of the leading languages of which French is one.

Publications Received.—The publishers of POPULAR ASTRONOMY hereby acknowledge the receipt of the following named publications and express their great appreciation of the courtesy shown on the part of those who have sent them.

(Continued from page 552.)

42. A Determination of Magnitudes, Spectral Types and Color Indices in the Scutum Cloud with a Statistical Discussion, C. J. Krieger. (Lick Observatory Bulletin, No. 416.)
43. Elements and Ephemeris of Comet *b* 1929 (Neujmin), by Ernest Clare Bower and Howard C. Willis. (Lick Observatory Bulletin, No. 417.)
44. A Spectroscopic Investigation of Beta Cephei, by Ralph N. Van Arnam. (Publications of the Dominion Astrophysical Observatory, Vol. IV, No. 12.)
45. Two Highly Eccentric Orbits, by W. E. Harper. (Publications of the Dominion Astrophysical Observatory, Vol. IV, No. 13.)

TAURUS.

Europa was so beautiful
That Jupiter became a bull
For love of her and off she went
On his white back from purple lands
To exile and gray Cretan sands:
Her name is on a continent.

1490 Stuart St., Denver, Colorado. LILIAN WHITE SPENCER.

LEO.

In radiant celestial spheres
The king of animals appears
Whose earth-life was notorious.
His hero-murderer is famed;
So are the Lion's big stars, named
Denebola and Regulus.

1490 Stuart St., Denver, Colorado. LILIAN WHITE SPENCER.